SCIENTIFIC AMERICAN

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Vol. XCIV.—No. 20.
ESTABLISHED 1845.

NEW YORK, MAY 19, 1906.

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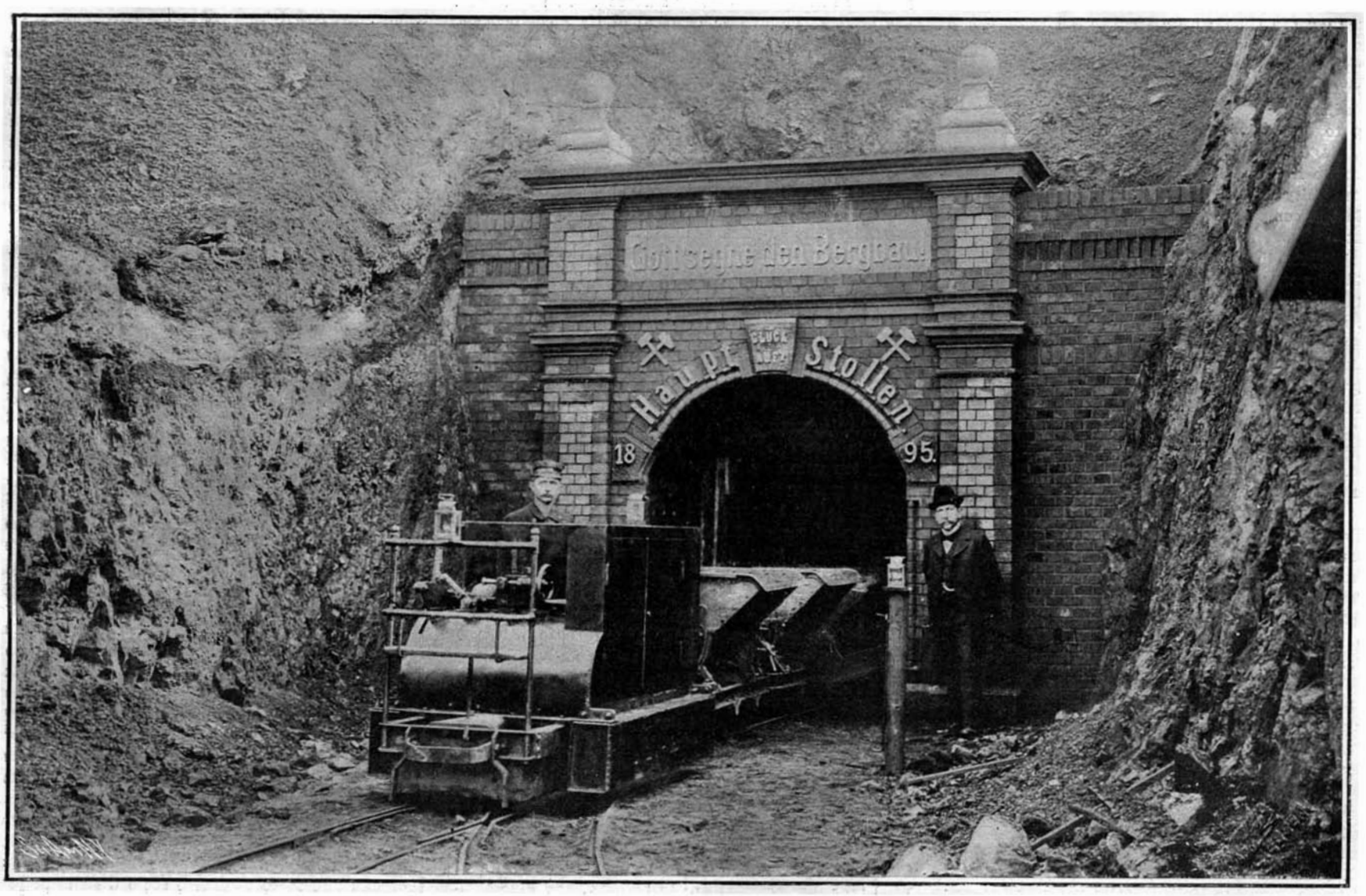
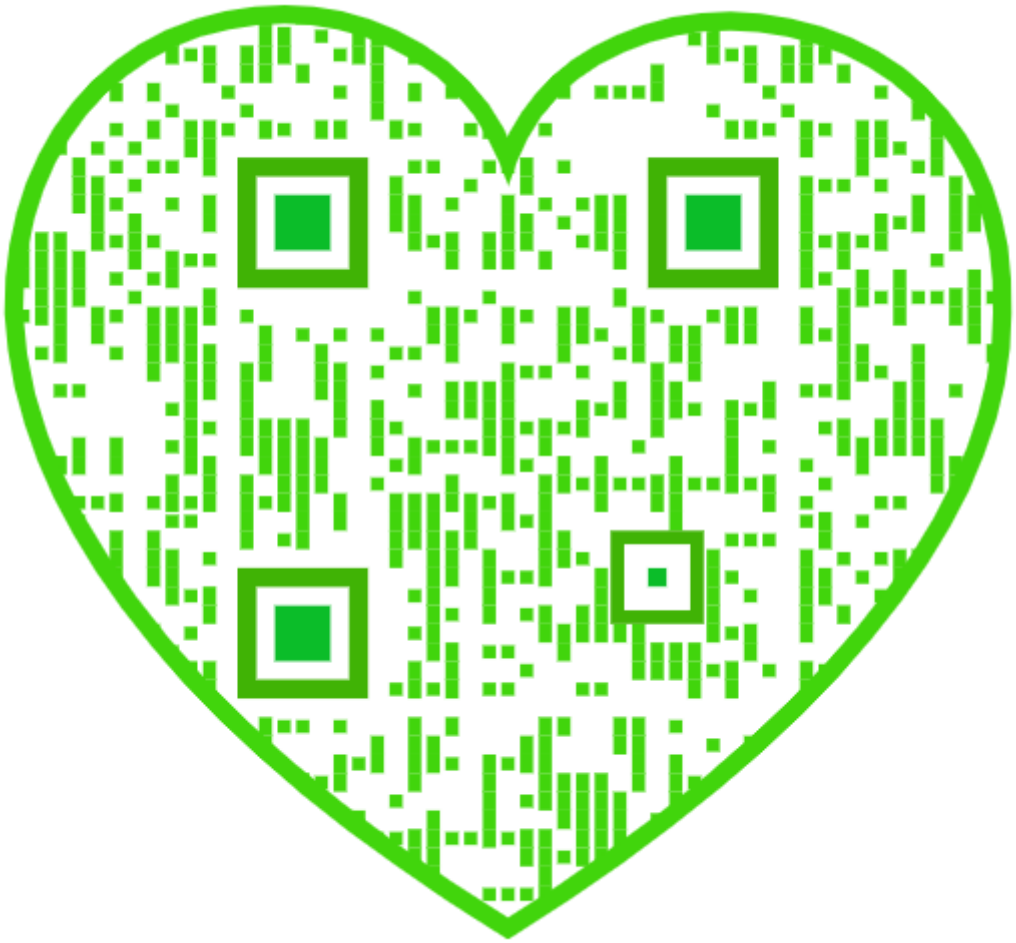
GASOLINE LOGGING LOCOMOTIVE.

AN 8-HORSE-POWER GASOLINE LOGGING LOCOMOTIVE.



GASOLINE MINING LOCOMOTIVE ENTERING A GALLERY.—[See page 412.]



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ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at
No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, MAY 19, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

PANAMA CANAL AND THE TEHUANTEPEC RAILROAD.

Not by any means the least of the important services rendered by the late Chief Engineer of the Panama Canal, Mr. John F. Wallace, was the word of warning which he sounded in a recent address with regard to the strong competition with which the canal will be confronted by the completion of the Tehuantepec Railroad. This railroad, which is being built in the interests of British capitalists, extends for a distance of 176 miles across the isthmus at Tehuantepec. According to Mr. Wallace, it is being built in a most substantial manner and provided with the very best facilities, equipment, etc., with a view to its handling a large amount of traffic at a minimum cost per ton. Wharves, warehouses, modern methods of loading and unloading, etc., will enable this railroad to conduct a profitable business at a rate not to exceed $2 a ton from ship hold to ship hold. The time from ship to ship should not exceed an average of two days.

It is assumed that modern cargo steamers can carry the average run of ocean freights with profit at the rate of $1 per thousand miles. On this basis comparison is made, first with transit by way of the Suez Canal, and then by way of the Panama Canal. From New York to Sydney, Australia, the saving in distance by way of the Tehuantepec Railroad would be 5,700 miles, and any railroad rate across the isthmus at Tehuantepec less than $5.75 per ton should take this business from the Suez route. There would also be saved the time that it requires an ordinary cargo vessel to steam 5,700 miles, minus the time required to transfer the freight across the isthmus by rail. Allowing a maximum of four days for the isthmian transit, this would make an actual saving of time of at least fifteen days. From New Orleans to Hong Kong, the saving over Suez would be 4,800 miles, and twelve to fourteen days in time, with a yield to the Tehuantepec Railroad of $4.80 a ton on the basis of equivalent charges by the Suez route. From New Orleans to Yokohama, the saving over the Suez route would be 8,400 miles, and twenty-four days in time, with the ability to charge $8.40 on an equivalent basis with Suez. As there is little question that this railroad can handle freight from ship to ship for $2 a ton or less, its ability to build up an extensive business to the Far East in competition with the Suez route is plainly evident.

Mr. Wallace then compares the Tehuantepec route with that by way of the Panama Canal, on the assumption that $1 per ton will carry ocean freights 1,000 miles, and that $1 per ton will be the minimum rate for transit through the canal. From New York to San Francisco the saving by Tehuantepec will be 1,200 miles, which would yield $2.20 as a maximum rate to the Tehuantepec Railroad. From New Orleans to Hong Kong the saving would be 2,000 miles, and five days in time, yielding the railroad a maximum charge of $3 per ton. From New Orleans to Sydney, Australia, 1,400 miles would be saved, and a maximum charge of $2.40 rendered possible; while from New Orleans to San Francisco there would be a saving of 1,800 miles.

From the above considerations it is evident that, in the years which will elapse before the completion of the Panama Canal, the Tehuantepec Railroad will undoubtedly build up a large and profitable business, which it will be difficult thereafter to divert back to the Panama route. The author of the paper, who is himself a former general manager of one of our largest railroads, considers that the remedy lies in the provision at Panama immediately of the proper facilities and equipment for the development of the maximum efficiency of that railroad, and the institution of a flat rate of not more than $2 a ton, and possibly as low as $1.50, in order to prevent other lines from diverting traffic from that route, and to encourage and expand the traffic which is tributary to it. Such a rate would immediately enable us to compete with the Suez Canal on all traffic from the United States ports to the Far East, and from the ports of Europe to those of Australia, Japan, China, and all points east of Singapore. On the basis of the above figures, Mr. Wallace is certainly justified in his statement that the failure of the United States to improve and utilize the Panama Railroad to its full capacity, and do it at once, may seriously affect the value of our Panama investment, which has already reached a total of $70,000,000.

SUPERHEATED STEAM IN RAILWAY SERVICE.

It is among the possibilities of the future that superheated steam will take the place of compounding as a means of increasing the efficiency of the steam locomotive. Considering that it is of very recent introduction, at least as far as its extensive and successful use is concerned, the locomotive superheater is making rapid progress; moreover, its development has been marked, as far as we know, by no serious failures, while from many quarters there come the announcements of exceedingly good results. One of the latest and most significant indorsements is that given by Mr. H. H. Vaughan, in a paper presented at the April meeting of the New York Railroad Club, dealing with the results obtained on the Canadian Pacific Railway, where the superheater is in extensive use, no less than 186 engines having been built, or now being constructed, of the superheater type.

The comparative data were obtained from a large number of consolidated and ten-wheel engines, which are identical, except for the fact that some of them are compound, and the others are simple engines with superheaters. The types of superheaters used are the Schmidt fire-tube and one designed by the mechanical engineer of the Canadian Pacific, and the author of the paper. The data were obtained while these engines were performing the same service on the same divisions of the road. Compounding has become, during the past few years, firmly established for freight service, and on account of the high cost of coal there would be no question as to its continuance, had not the superheater been applied to locomotives with simple engines. The records show that on the four sections of the road on which the records had extended over a sufficient period of time to give reliable comparison, the simple engines with superheaters consumed, on the respective divisions, 85 per cent, 87 per cent, 83 per cent, and as low as 76 per cent, of the amount of coal consumed by the compound engines under similar conditions of service.

The failure of one class of superheater locomotives to show as good results as the others, the figures being respectively 97, 100, 96, and 82 per cent, serves to bring out the fact that the gain in economy is commensurate with the increase of the amount of superheat; for this particular class of engine was using only 20 degrees of superheat, as against 80 to 100 degrees in the class which showed such marked superiority to the compound. The results are so encouraging that on the new engines now under construction the proportions of the superheating surface will be increased. The system is found to be particularly advantageous in passenger service, and thus far in the operation of these locomotives no serious counterbalancing disadvantages have been developed.

REBUILDING THE RUSSIAN NAVY.

The construction programme for the rebuilding of the Russian navy, which was recently sanctioned by the Czar and is to be spread over a term of nine years, would seem to indicate that the Russians have not themselves drawn from the experience of the late war the same cardinal lessons as Japan and the other naval powers; for in the list of battleships and cruisers which are to be laid down there does not appear to be a single vessel of the type of the "Dreadnought," or our own "Michigan"—that is to say, the type of ship in which the intermediate battery is abolished and the main armament consists entirely of guns of heavy caliber. According to the Neue Freie Presse, the programme includes twelve battleships, fifteen cruisers, forty-six torpedo-boat destroyers, eighteen torpedo boats, ten submarines, seven gunboats, nine monitors, and one mining ship, or 118 vessels in all. These ships are allotted as follows: For the Baltic Sea fleet there will be nine turret ships of about 16,500 tons displacement, carrying four heavy, fourteen intermediate guns, and fifty-six rapid-fire guns—a very modest battery for this late day; four cruisers of 12,000 tons, each carrying forty quick-firing guns; eighteen 300-ton torpedo boats; a mining ship of the type of the "Yenisei," and ten submarines. For the Black Sea fleet, there will be built three 12,500-ton battleships to carry four 12-inch guns, four 7¾-inch, twelve 6-inch, and a number of quick-firers; seven first-class cruisers of 12,750 tons, which is about the size of the "Gromoboi;" four second-class cruisers of about the size of the "Pallada," but having two to four knots greater speed, and twenty-eight 350-ton torpedo boats. That Russia has given up, for the present, at least, any idea of a powerful fleet in the Far East, is shown by the fact that for that station only six coast gunboats of 1,000 tons displacement are to be built, and nine shallow-draft gunboats for use on the rivers of northern Siberia. The total cost is estimated at about $200,000,000, which is to be allotted in nine annual installments. Adding this to the sum required annually for the current expenses of the navy, we find that the Russian naval budget for the next nine years will amount to $80,000,000.

THE DISCOVERY OF THE ANCIENT HEBREW TEMPLE OF ONIAS IN EGYPT.

One of the most valuable discoveries of the British School of Archæology in Egypt during the past winter season was the identification of the ancient Hebrew Temple of Onias by Prof. Flinders Petrie. When the persecution of the Jews by Antiochus caused them to flee, many of the fugitives settled in a remote corner in the east of the delta, and in this sanctuary Onias IV., of the high priests, erected a temple after the design of that at Jerusalem, in order that this spot might serve as a rallying point for those in flight. This temple is duly mentioned by the historian Josephus, who states that it was erected on the site of an old Egyptian town. Some time ago it was realized that the position of this settlement was the town of Tel el Yehudiyeh, which is some 18 miles north of Cairo, but it has been left to Prof. Petrie to prove the identity of the location conclusively, and in this work he has found the closest corroboration, even to the minutest particulars, of the statements set forth by Josephus.

Prof. Petrie has published an account of his discoveries and thus another interesting link in Jewish history has been established. The ancient name of this town was Leontopolis, in honor of the lion-headed goddess "Bubastis," and this fact was irrefutably shown by the discovery of the statue of an admiral of the Mediterranean fleet of Psametek II., representing him holding a shrine of the goddess in question. Josephus also states that the place is "full of materials," a fact fully borne out by the finding of an extensive stone-built ditch, about one mile in length, extending round the ancient Egyptian town, and which would have furnished Onias with ample constructional material for his temple. Outside the confines of the town is a huge mound which constitutes quite an important landmark for miles around, and on investigation Prof. Petrie finds that its height is practically in accordance with the dimensions mentioned by Josephus, it being over fifty-nine Greek cubits above the level of the surrounding plain, the Jewish historian's figures being sixty cubits in height. Examination of the pottery that was found within this mound identifies it with the second century B. C., while the coins which have been brought to light are of the period of Ptolemy Philomator, whom Josephus states granted the whole settlement, while a sherd unearthed with building accounts, bearing among other names that of Abram, affords convincing testimony that Jews were employed. Under these circumstances the well-known archæologist who has carried out the excavations is firmly convinced that this is the site upon which Onias erected his temple.

The ground plan of this settlement is roughly a right-angled triangle, and it was strongly fortified. On the eastern side was an eastern wall of stone 767 feet in length by at least 20 feet in height, and terminating in bastions at the ends. The entrance was at the west acute angle, while the temple was at the south point. The hypotenuse of the triangle was formed of an inwardly curving wall not less than 20 feet in thickness, rising to a height of 68 feet, at an angle of over 60 degrees, to support the temple, entry to the court of which was attained by means of a stairway 14 feet in width in the eastern wall.

The settlement covered an area ranging from three to four acres in extent, and the sacred edifice was exactly half the size of the Temple erected in Jerusalem by King Solomon. The rough lines of the structure built by Onias are now only visible owing to the vandalism of the natives in quest of earth, but about twenty years ago the walls were standing and the pavements and pillars were then extant. Prof. Petrie finds that the inner court of the Temple was 64 feet in length by 24 feet in width, while the outer court was 45 feet long by 32 feet wide, inside measurements. The architecture was Corinthian with Syrian features in the battlements. When the natives first commenced excavating earth from the site some years ago vast quantities of burnt bones were revealed, and the probability is that they were the remains of the daily sacrifices. Evidences of this have been discovered in the foundations, since in the lower part have been unearthed on all sides huge cylinders of pottery sunk in the ground in which the sacrifices were celebrated, fresh earth being thrown upon each fire offering, in order to smother it, so that traces of sacrificial rites remain alternate with layers of earth. Unfortunately, however, the valuable work carried on by the school is hampered by the lack of funds, which is a regrettable fact, since the evidences of wanton destructiveness upon this site show the imperative nature of carrying out the excavation and research work in Egypt upon a thorough and more extensive scale than is at present possible.

EXPORTS OF AGRICULTURAL PRODUCTS.

Agricultural products are now making their highest record in the exportations of the United States, and should the present rate continue during the remainder of the fiscal year the total exportation of such products will in 1906 for the first time cross the billion dollar line. In the eight months ending with February, for which the Department of Commerce and Labor, through its Bureau of Statistics, furnishes the detailed figures, the value of agricultural products exported amounted to 700 million dollars, which is a total considerably in excess of the figures for a similar period in any preceding year. Contrasting the figures of 1906 with those of 1896 and 1901, the growth is strongly marked. The total value of agricultural products exported for the eight months ending with February, 1906, was 700 million dollars; in 1896, the total was but 404 millions, and in 1900, 570 millions, while the largest total previously shown for the eight months ending with February was 664 million dollars in 1902. The total for the 8 months ending with February, 1905, was but $568,000,000.

This growth occurs in all of the three great groups which form the bulk of agricultural exports, viz., breadstuffs, cotton, and provisions, the latter term including meats and dairy products. The largest increase occurs in breadstuffs in which the gain is $70,000,000; provisions show a gain of $33,000,000, and cotton a gain of $30,000,000, each compared with the corresponding months of the immediately preceding year. The group "breadstuffs" includes wheat, wheat flour, corn, oats, barley, and other cereals, cereal preparations, for table food, etc., and in nearly all of these articles there is a marked growth in the eight months ending with February, 1906, compared with the corresponding months of the preceding year. Wheat shows an increase from $3,710,550 in the eight months ending with February, 1905, to $22,621,958 in the eight months ending with February, 1906; flour, an increase from $26,723,329 to $42,098,842; corn, from $27,010,061 to $46,760,572; oats, from $405,283 to $11,255,229; barley, from $3,991,711 to $6,749,364, and corn meal from $575,350 to $1,043,297. The increase in exports of wheat is chiefly due to the shortage in our own supply which existed in 1905, and a return to normal conditions in 1906. In the eight months ending with February, 1905, only 4,196,090 bushels of wheat were exported, while in the same months ending with February, 1906, the number of bushels exported was 27,467,298. Of flour the exports for the corresponding months of 1905 and 1906 were 5,853,507 barrels and 9,785,399 barrels. Of corn the quantity exported in the eight months ending with February, 1905, was 50,938,169 bushels, and in the same months of 1906 88,234,903 bushels, while of oats the total exports in the eight months of 1905 was 959,941 bushels, and in the same months of 1906, 32,714,453 bushels.

These increases in the exports of breadstuffs occurred chiefly in the movement to European countries. To the United Kingdom corn exports increased 14,000,000 bushels; oats, 13,000,000; wheat, 6,500,000, and flour, 2,000,000 barrels. To Germany corn exports increased 10,000,000 bushels; oats, 6,000,000; wheat, about 2,500,000, while flour shows but a small increase.

Cotton shows an increase of $30,000,000 value in exports during the eight months ending with February, 1906, compared with the corresponding months of last year, but a decrease in quantity, the total number of bales exported in the eight months ending with February, 1906, being 5,399,055, against 5,879,327 in the same months last year. The increase in value of exports by countries occurs in the movements to the United Kingdom, France, Germany, Italy, Russia and Canada and a decrease in the movements to Belgium, Japan, Netherlands, and Mexico. In quantity, however, the figures show a decline in movements to all the principal countries except France and Canada, the increase in total value being due to the high average export value per pound, that in 1906 being a little over 11 cents per pound, while the average value per pound in the eight months ending with February, 1905, was slightly more than 9 cents.

In the group designated "Provisions" the total increase is $33,000,000, a gain in which nearly all the classes participate to a greater or less extent. Lard shows an increase of $11,000,000; oleomargarine oil, $4,000,000; bacon, $6,000,000, and butter nearly $3,000,000.

While agricultural exports are larger in total value than ever before, it does not follow that they form a larger percentage of the grand total of exports. On the contrary, the percentage which they form of the total exports in the eight recorded months of the fiscal year 1906 is smaller than in any earlier year in our history, except 1905, in which they were abnormally low by reason of the shortage in the grain crop of 1904. The percentage which agricultural products form of the total exports in the eight months ending with February, 1906, is 59.3, against 63.8 in 1904, 66.2 in 1902, 68.9 in 1899, and 71.9 in 1898, considering in each case the corresponding months of the year named. This indicates that other great groups of our products are increasing even more rapidly proportionately than that designated as agricultural products, and this relative gain in percentage of the total exports occurs chiefly in manufactures.

The percentage which manufactures form of exports in the eight months ending with February, 1906, is 32.8, while they formed but 27.2 per cent of the total exports in the corresponding months of 1903, 22.5 per cent in the corresponding months in 1898, and 16.5 per cent in the corresponding months of 1890.

ELECTRICITY FOR CANALS.

Vice-Consul Fuller, of Hanover, writes that among the latest developments of mechanical power the propulsion of canal boats and barges by electric power promises a new life to canal traffic. His letter reads: "Siemens & Halske have brought out a new method of electric traction, which is already in use on the Teltow Canal. The first experiments of an electric canal boat were unsatisfactory, but the present system seems to entirely meet all requirements. Originally the engines were built symmetrically, so that boats could be towed at will either up or down the canal. This plan turned out to be unsatisfactory, and a double system of rails, one on each side of the canal, was tried. This proved to work well and is the system now in use.

"The gage of the line is 100 millimeters, the distance between the wheels 3,700 millimeters. Both wheels run on rails, as the idea of running one wheel on a rail and the wheel nearest the canal on the ground did not give the best results. The wheel frame has in front a turning frame with wheels 1 meter apart, and a fixed pivot, and a hind longitudinal axle. The total weight of the locomotive is so distributed that the wheels on the land side have to bear the greater portion (six-tenths) in order to keep up the equipoise of the tow-rope. For the same reason the pivot of the turning frame is not in the longitudinal axle of the locomotive, but 300 millimeters outside the same toward the land side. Both axles of the turning frame are worked by a 10-horse-power direct-current motor with double-cogged gearing. The motor works at a tension of 550 volts, the speed and steering being regulated by the usual parallel series. When traveling without load, the locomotive can go at a speed of 5 kilometers per hour when the series is used, and when the parallel multiple is used, at a speed of from 9 to 10 kilometers per hour.

"The tow pole is worked by a 1-horse electro motor specially provided for the purpose. At the upper end of the tow pole is a funnel through which the towing rope is led, and then wound round a drum. To work this drum there is another electro motor provided which has a drawing power of more than 120 kilogrammes. An automatic coupling connects the drum with its shaft, so that in case of any overburdening the stability of the locomotive may not be endangered. The driver's place is fixed in front and contains all the controllers for the various motors, the switch for working the tow pole, and a switchboard for the gages. The locomotive is also provided with the necessary accessories.

"The tests to which these locomotives have been subjected have proved that they are thoroughly efficient, and at the same time that they are extremely economical."

LORD KELVIN'S CONCEPTION OF AN ATOM.

Lord Kelvin, in an article on "Atom with Enormous Energy for Radio-activity," published in the Philadelphia Magazine, puts forward a plan of an atom capable of storing an electrion (or negative electron) with enormous energy for radio-activity. The atom of ponderable matter is supposed to be intrinsically charged in concentric spherical shells, each such layer being uniform in itself but the density and sign of the distribution varying from layer to layer. A curve, called the work curve, is then plotted, whose ordinates show the work required to bring an electrion from infinity to the point in question. In the curve drawn there are two minima, one just within the radius of the atom and a second at its center. Between these two minima there is one maximum. The curve is of course symmetrical about the center of the atom. If therefore an electrion be placed at or near the center of the atom, i. e., between the two maxima of the work curve, it has stability, but only through a narrow range. If it is taken farther away from the center than these maxima, the electric force of the atom upon it will shoot it out of the atom with prodigious velocity, which will be but slightly diminished by the attraction of the whole atom when it gets outside.

In a paper on catgut strings, published in the American Journal of Science, J. R. Benton deals with tests of the mechanical properties of the catgut strings used on musical instruments, most of the experiments being carried out with a violin E-string. The results are briefly as follows: Elongation at rupture 15 to 19 per cent of original length. Tensile strength 43 kilogrammes per square millimeter, or 60,000 pounds per square inch, as against wood 20,000 pounds per square inch, leather 5,000, and hemp ropes 15,000. Length of a given string and the relative humidity of the air being simultaneously observed and plotted as functions of the time show: (1) Increase of length with increased humidity, and (2) a time lag of length-increase after the increased humidity to which it is due. Young's modulus has a value 322 kilogrammes per square millimeter, or 458,000 pounds per square inch. It was also sought to determine the coefficient of thermal expansion. This appeared to be negative, but the results were probably more a matter of humidity than thermal effects pure and simple.

SCIENCE NOTES.

In a paper lately presented to the Académie des Sciences, Messrs. Besson and Troost bring out the action of peroxide of nitrogen upon ammonia and its salts. Before attempting to use peroxide of nitrogen as a solvent for the ammoniacal salts, they observed the following points. If we bring ammonia gas which is liquefied and solidified at —80 in contact with solid peroxide of nitrogen cooled to the same degree, a violent explosion is produced, giving off abundant fumes. The reaction is more moderate if we bring a current of dry ammonia gas cooled to —20 degrees upon the cooled peroxide of nitrogen contained in a tubulated retort, the latter being connected with a condenser. A vacuum has first been made in the apparatus. The reaction causes a great heat, and a temporary formation of nitrous acid as a green liquid, also giving off white fumes. The gases given here are formed essentially of nitrogen mixed with nitric oxide, N O. When the reaction stops there remains in the crucible a white salt which consists of nitrate of ammonia. The main reaction of the ammonia gas upon the peroxide of nitrogen in the above case is as follows: (*a*) $3\,N\,O_2 + 4\,N\,H_3 = 7\,N + 6\,H_2O$. (*b*) $3\,N\,O_2 + 2\,N\,H_3 + H_2O = N\,O + 2\,(N\,O_3 + N\,H_4)$. The peroxide of nitrogen acts slowly when cold upon $N\,H_4\,Cl$, which is liquefied at its contact. To complete the reaction it is well to heat for some time to 100 deg. C. in sealed and strong tubes. The considerable gas pressure which we observe on opening the tubes is due to chlorine and a mixture of nitrogen and nitrous oxide. As to the brownish liquid remaining in the tubes, it is separated by fractional distillation into oxy-chloride compounds of nitrogen, nitrous anhydride, an excess of nitrogen peroxide, nitric acid and a residue consisting of a little nitrate of ammonia. It is found that peroxide of nitrogen acts upon nitrate and sulphate of ammonium in the same way as upon the chloride, but only nitrogen is given off in this case. The liquefied mass forms two superposed layers. The upper layer is formed of peroxide in excess. After eliminating it by distillation, there remains nitric acid in the first case, and a mixture of nitric and sulphuric acids in the second.

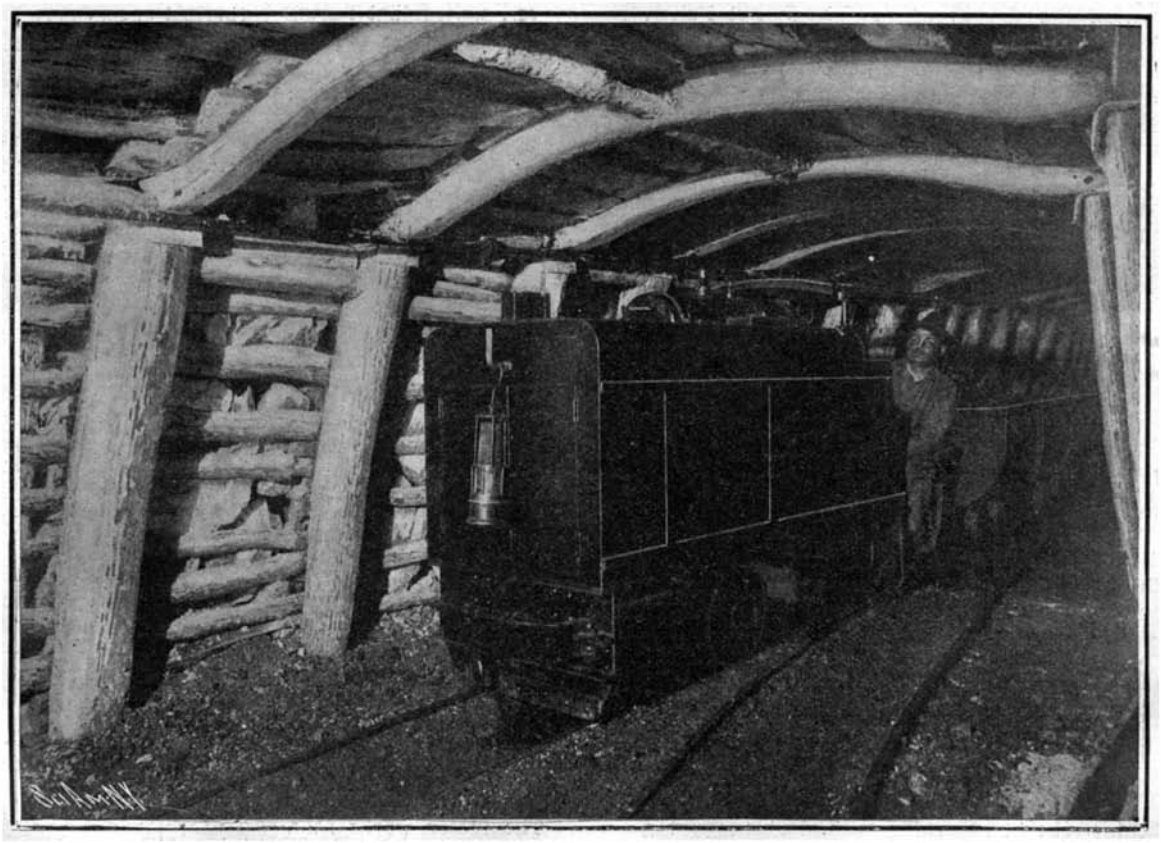
Messrs. Bordas and Touplain, of Paris, have lately brought out a new method of determining the different foreign products contained in cocoas and chocolates. In the observations which they made on high-speed centrifugal separators for the rapid analysis of alimentary matters such as milk, chocolates, cocoas, etc., they found that the elements in suspension in the liquid are deposited in the tubes of the apparatus in the order of their density. This was especially evident for the insoluble matters composing the chocolates and cocoas. In the insoluble part of the deposit they could distinguish well-defined series, having different colors. They wished to utilize this so as to separate not only the different elements which compose the chocolates, but also the waste products which they may contain, such as hulls, etc., as well as matter which is purposely added for adulteration. Up to the present it was found to be a difficult matter to separate the waste parts of the plant and it was almost impossible to detect small quantities of foreign bodies. Microscopic examination was a long and often unfruitful operation and we cannot estimate even approximately the amount of foreign matter contained in the chocolate or cocoa. The authors found a method which is practical and gives good results in separating the foreign bodies. The process consists in preparing a series of liquids of variable densities from 1,340 to 1,600 in which the powders mixed with the liquids will either sink to the bottom or float on the surface. Tetrachloride of carbon is used to start with, and by diluting it with benzine we diminish the density as desired and obtain a series of liquids having known densities. Naturally, we must first free the chocolate from its fatty matter as well as from bodies which are soluble in water, and the insoluble part is pulverized and dried. The precipitation of the powder is facilitated by using the centrifugal apparatus, and by a series of simple decantations we can separate the floating parts from the portions which are precipitated to the bottom of the tube. The product is collected on a filter and it is weighed after a previous microscopic examination. By this very simple method we may thus examine chocolate and cocoa, besides other food products reduced to powder, such as coffee, pepper and spices.

GASOLINE LOCOMOTIVES.

BY OUR BERLIN CORRESPONDENT.

Locomotives driven by gasoline motors possess a number of special advantages which particularly adapt them for use on temporary forest and field railways, and mining railways. They are also useful as drill engines, in which conuection they even prove preferable to electrical locomotives, dispensing as they do with the necessity of a special power station and current-conducting lines. Steam operation is on the other hand quite impracticable in mines, and in the case of forest railways gives rise to the danger of fire, especially in dry weather, owing to the sparks flying about.

The construction of motor locomotives for benzine, alcohol, and gasoline operation has been developed by the Deutz Gasoline Motor Works, of Cologne-Deutz, Germany, to whose courtesy we are indebted for the accompanying photographs representing some typical plants. The general arrangement of these motor locomotives is as follows: A horizontal motor is mounted on a frame resting by means of springs on the running axles, the power of which motor is transmitted to these axles through the intermediary of gearing situated at the side or rear of the motor. In the case of mining and field railway locomotives, the fuel reservoir is inserted in the cooling water reservoir, both being located above the motor. In drill engines and motor cars for the operation of tramways, the water reservoir rests on the frame, while the fuel reservoir is situated above the motor, as in the case of mining and field railway locomotives. The various parts of the engine are protected against dust by means of a sheet-metal casing. Ignition is effected by a magneto operated by the engine. The power is transmitted to the running axles by means of a chain and sprocket wheel thrown in and out of gear by friction clutches. According to the conditions of the case, the locomotives are designed with one, two, or more transmissions in the driving gear, admitting of both forward and backward running at the speed produced by the latter. Single transmission locomotives are mainly used in mining plants, where only small gradients are generally to be dealt with at moderate speeds (about 3.75 miles per hour). For any higher speed on horizontal tracks or for the hauling of trains over steeper gradients, the locomotive is fitted with a driving gear having two or more transmissions. The maximum speed of these locomotives is reduced either by using greater ratios of transmission or by acting on the governor. In order not to vitiate the air, the exhaust gases of mining locomotives are entirely condensed. These engines are designed for any outputs intermediary between 6 and 60 horse-power.



AN 8-HORSE-POWER GASOLINE MINING LOCOMOTIVE.

A Norwegian inventor has devised a process to convert the Iceland moss, the nutritive and curative qualities of which are well known, and which is in great demand in Europe, into a succulent and nourishing edible. The lichen, after being thoroughly rinsed, is soaked in a boiling solution, by which means the bitter element is extracted from the plants. After being subjected to this process the moss is submitted to a second rinsing, after which it is ready to be packed.

A NEW MACHINE FOR ENGRAVING STEEL PLATES.

BY A. FREDERICK COLLINS.

The old and honored art of wood engraving has practically suffered extinction in recent years from competition wrought by the inventions of the half-tone and zinc-etching processes; and the facility, precision, and greatly reduced cost of the latter in reproducing all manner of drawings, photographs, and paintings by adept manipulation have given these substitutes a wide and constantly increasing popularity.

There is another branch of the allied arts that has more successfully resisted the onslaughts of mechanical methods, and this is the engraving of steel plates by hand, yet this too has at last succumbed to the ingenuity of the inventor, and a machine has resulted which is even now working a silent but none the less effective revolution in the most useful of all the industries, namely, printing.

Engraved stationery has been expensive from time immemorial, for the reason that each letter must be cut tediously and with exactness by hand, and an expert engraver cannot produce more than one hundred letters a day; but by means of the new engraving machine shown in the illustrations, a boy can cut upward of three hundred letters per day, and with an accuracy that hand work cannot nearly approach, while the dies thus made do not, as is evident from what has been said, approximate more than a mere fraction of the expense entailed by hand labor.

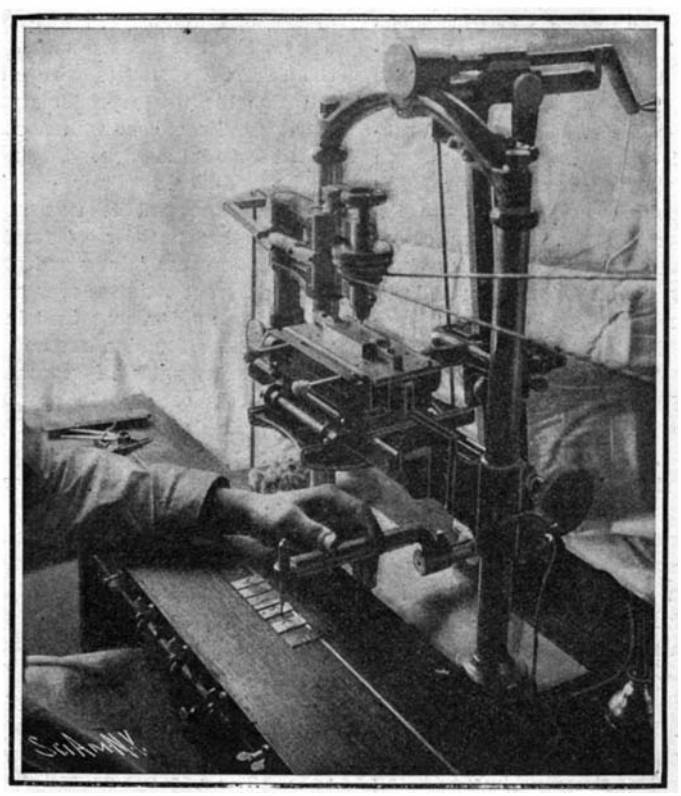
The machine in question, which is the invention of Mr. William S. Eaton, is an excellent example of how persistent and well-directed effort will overcome the greatest obstacles, either by circumvention or elimination, for it has required many years of experiment to reduce it to a commercial form, wherein it would do the work better and cheaper than a skilled engraver, and this together with other improvements has brought the price of engraved stationery almost to the level of common printing.

Before entering into a detailed explanation of the various functional parts of the new engraving machine, it may serve to make the following text clearer by saying at the outset that it embodies the principles of a pantograph and, like that instrument, it makes a copy of a letter or other design either on the same scale or with a reduction or increase in size as desired. With a pantograph the tracing is made by means of a stylus; but in the engraving machine, instead of following a mere line, it traces the original or pattern letter in the form of a groove which has been previously cut, while the reproducing head consists of a routing tool, formed of a revolving steel point which cuts away and deepens the line on the steel plate with amazing rapidity.

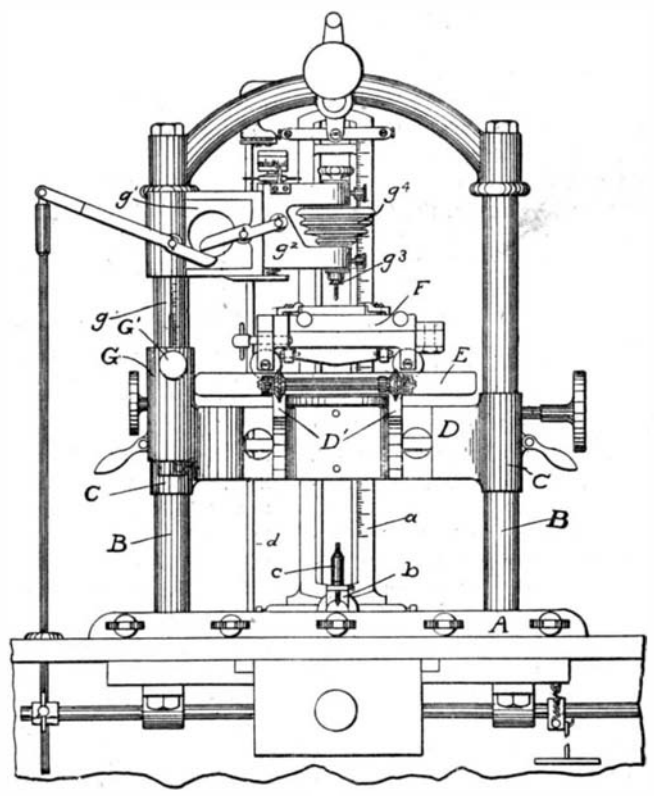
By referring to the photograph, Fig. 1, and the front elevation, Fig. 2, it will be seen that the machine as a whole comprises a table which carries the support, *A*, on which the original or pattern letters are held, and which are to be reproduced on the steel plate. To this table two standards or guides, *B B*, are bolted, while the top is held rigid by an arcuated cross-bar, as a reference to the front elevation shows. On these guides are sleeves, *C C*, provided with lugs, by means of which the former may be clamped to any desired point. The crosshead, *D*, is provided with brackets, the upper faces of which form V ways. Moving lengthwise of the machine in these ways, D^1, is a carriage, *E*, supported by beveled wheels. On this carriage rests a frame carrying similar ways, and these are arranged in a horizontal plane parallel to the ways, D^1, and perpendicular to them.

A second carriage, having wheels similar to those above described, moves laterally in the ways on the carriage, *E*, and this supports the work-bed of the machine, *F*, to which it is secured by a pivot placed against its surface, this permitting the withdrawal of the work beneath the routing tool for the purpose of inspection. Normally, the bed-plate which holds the steel block to be engraved is maintained upon the carriage by means of a movable stop, while on the surface of the carriage there are adjustable clamps for securely holding the work in position.

Carried by the crosshead, *D*, and integral with it is the guide sleeve, *G*, in which the vertical bar, *g*, is mounted, carrying a support, g^1, for the spindle carrier, g^2; this is furnished with a rack and pinion, by means of which the carrier may be adjusted vertically independent of the movement of the crosshead, *D*, and the work-bed carried by it. The spindle carrier moves vertically with the ways of the support, and is provided with arms on which is mounted a spindle, g^3, having a chuck for holding the routing tool. To this spindle there is attached a stepped pulley, g^4, driven by a small electric motor.



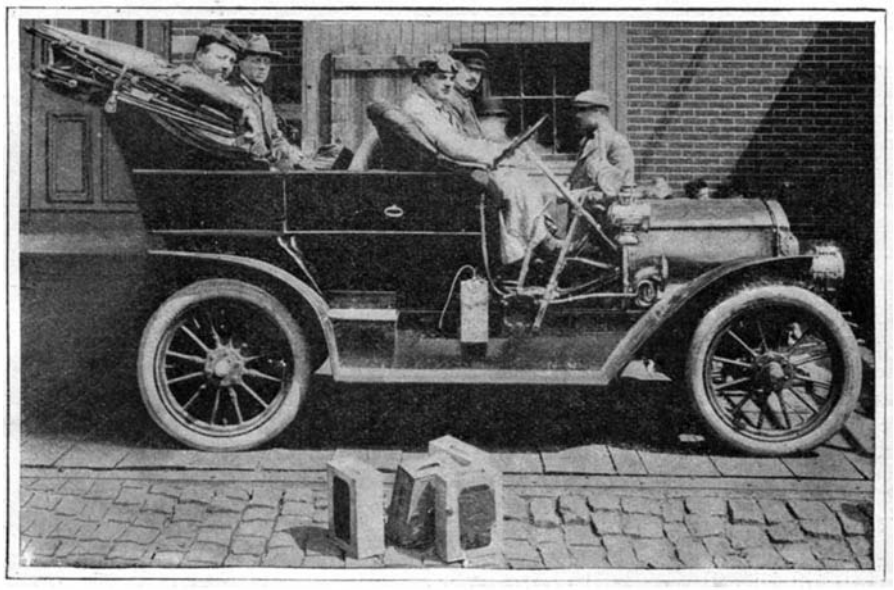
The Steel-Plate Engraving Machine, Showing Pattern Letters and the Routing Tool in Position on the Steel Block.



Front Elevation of the Steel-Plate Engraving Machine.

A NEW MACHINE FOR ENGRAVING STEEL PLATES.

(*Continued on page 415.*)

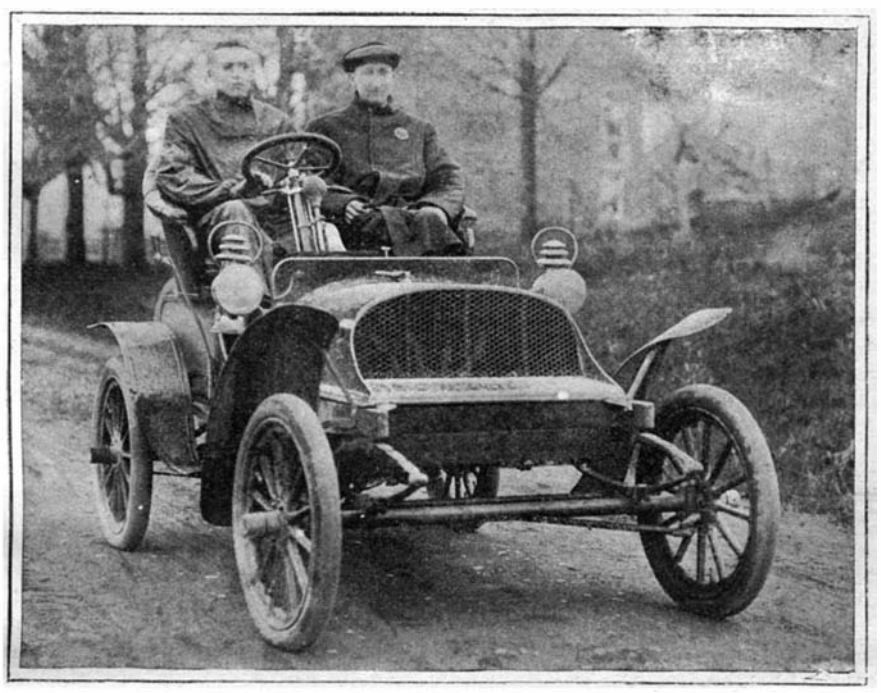


Weighing-in the 24-Horse-Power Air-Cooled Frayer-Miller Touring Car, Which Obtained Second Place.

This car covered 47.9 miles in the test and 59.8 miles subsequently. It weighed 3,270 pounds, and covered 156,633 pound-miles at a cost for fuel of 0.517 cent per ton-mile.

Refilling the Fuel Tank of the 24-Horse-Power Darracq With Gasoline at the End of the Run.

This car, of the regular four-cylinder water-cooled type, carried five passengers and covered 46.44 miles (equal to 144,428 pound-miles), at a cost for fuel of but 0.553 cent per ton-mile. It obtained third place.

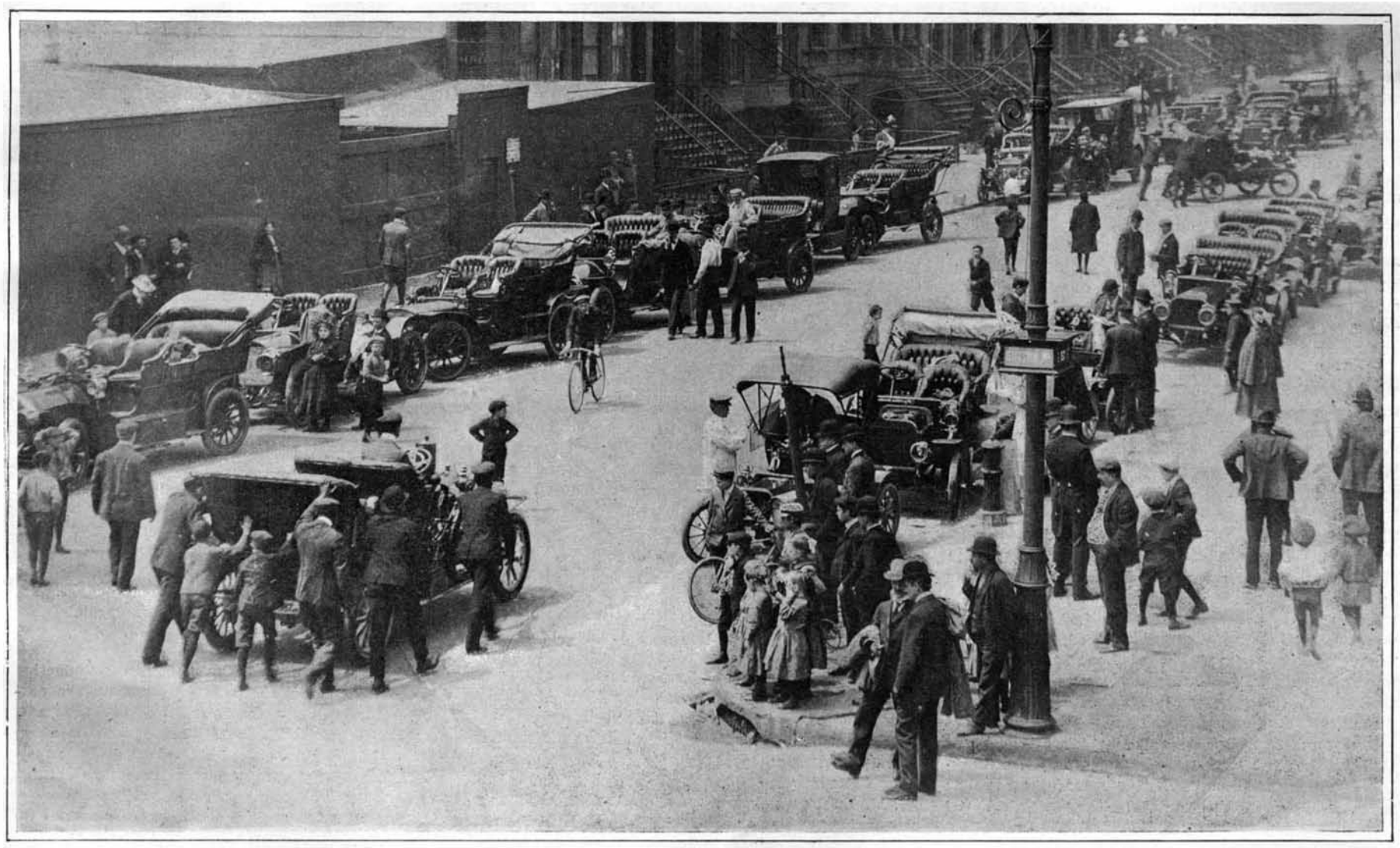


The Winning Franklin 4-Cylinder Air-Cooled Runabout With Arthur Holmes Driving and Our Automobile Editor Acting as Observer.

The photograph shows where the car stopped, at 6:55 P. M., in North Haven, Conn., a distance of 87 miles from the starting point. The car weighed loaded 1,500 pounds, and covered 130,500 pound-miles, at a fuel expense of 0.613 cent per ton-mile. It made 95 miles on two gallons subsequently.

Light-weight Orient Buckboard Fitted With 4-Horse-Power Air-Cooled Motor and Friction Disk Transmission.

This machine covered the greatest distance—98.8 miles—on two gallons of gasoline. It weighed 930 pounds, and made 91,884 pound-miles. This brings the cost per ton-mile for fuel up to 0.876 cent.



Automobiles With Empty Gasoline Tanks and Carbureters, Lined Up on East 57th Street Before They Were Inspected, Filled, and Weighed In.

THE TWO-GALLON FUEL EFFICIENCY TEST OF THE AUTOMOBILE CLUB OF AMERICA.

THE WINNING CARS IN THE AUTOMOBILE CLUB OF AMERICA'S TWO-GALLON FUEL EFFICIENCY CONTEST.

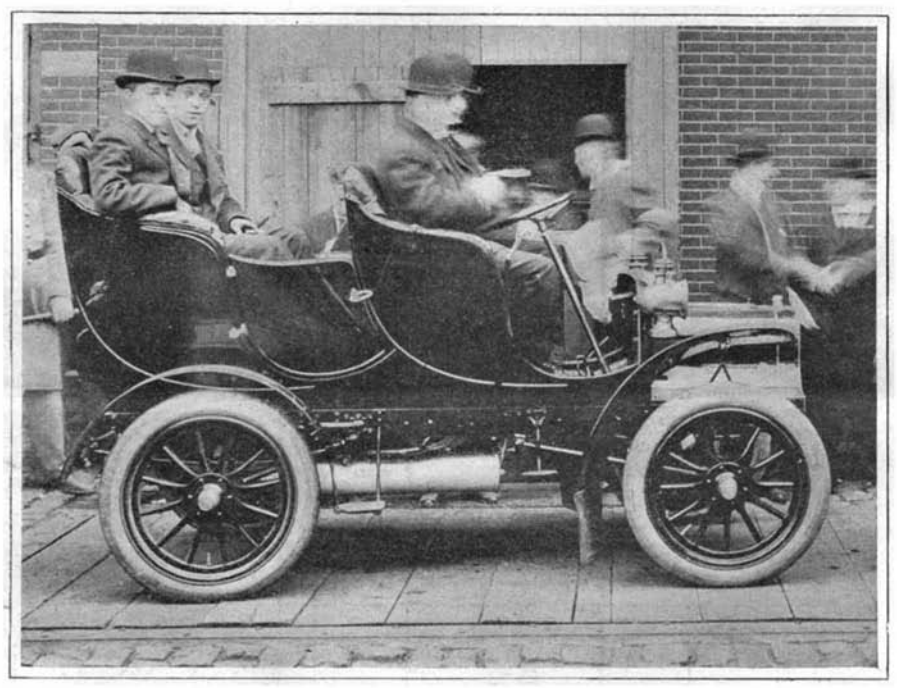
We reproduce herewith photographs of the cars which won the first, second, and third prizes, as well as two single-cylinder automobiles that made the best showing in their class, in the fuel efficiency contest conducted by the Automobile Club of America, on May 5. As has been previously noted in these columns, the prize was won by a four-cylinder light runabout of the air-cooled type, and the second and third places were taken by large four-cylinder cars of the air-cooled and water-cooled types, respectively. The contest gave a practical demonstration of the well-known theory that an air-cooled car is more economical than a water-cooled car. This theory can now be taken as an established fact, since it was proven to be correct not only with a light automobile of low horse-power, but also with a large, high-powered touring car as well. The covering of 87 miles upon two gallons of gasoline by the Franklin runabout caused a great deal of comment by those well informed in automobile matters. As noted in our last issue, this distance was covered under adverse conditions, and we prophesied that under favorable conditions at least 90 miles could have been made. In order to put a stop to all criticism the Automobile Club had the Franklin and Frayer-Miller cars repeat the test on the 8th instant. A thorough inspection was made before the start, and the officials were satisfied that no extra supply of gasoline, other than the two gallons put in the tank, was available. As a result of this test, the Franklin runabout covered 95 miles upon two gallons of gasoline and the Frayer-Miller touring car 59.8 miles. The record of the runabout for economy of fuel stands, we believe, unbroken among records of this character the world over to-day.

The car which obtained third place was a 24-horse-power Darracq touring car carrying five passengers. Machines of this make have made records before for speed, endurance, and economy, and it was not a surprise to see one of these cars, when owned and driven by an amateur having the qualifications that has Mr. S. B. Stevens, win such a prominent position. Another large French touring car of 24 horse-power, the Berliet, obtained fourth place. A 16-22-horse-power four-cylinder touring car of this make holds the record of being driven 100 kilometers (62.1 miles) in 1 hour, 21 minutes, and 11 3-5 seconds with a fuel consumption of but 2.37 gallons. The American Locomotive Company is building this machine in America.

The machine which obtained fifth place was a 20-passenger Mack bus of 50 horse-power. This huge car weighed 9,325 pounds complete, and covered 17.13 miles upon its two gallons of fuel, making a total cost of operation of one-half cent per ton-mile. Sixth place would have been obtained by the single-cylinder Cadillac touring car shown herewith on the scales, had it not been that this car was handicapped by the deduction of 30 per cent of its weight from the total weight, which was 2,250 pounds. Carrying four passengers, the machine covered 55.5 miles, making 124,875 pound-miles in all at a cost of 0.646 cent per ton-mile. The sixth place went to a Franklin 12-horse-power light touring car, which weighed 2,140 pounds and covered 58.4 miles at an average cost of 0.64 cent per ton-mile for gasoline. The next six places were taken by the Queen 26-28 horse-power, 4-passenger, touring car (weight 3,160; distance 41.4); the Stoddard-Dayton 30-horse-power, 5-passenger touring car (weight 3,200 pounds; distance 40.83); the Lozier 40-horse-power, 6-passenger touring car (weight 4,490; distance 30.28 miles); the Renault 14-horse-power, 3-passenger brougham (weight 3,400 pounds; distance 31.61 miles); the Darracq 20-32 horse-power, 4-passenger touring car (weight 3,600; distance 34.62); and the Compound 16-horse-power, 5-passenger touring car (weight 2,635 pounds; distance 43.5 miles). A complete list of all the cars which finished, giving their position, weight, score, distance traveled, and the number of pound-miles covered, will be found in the current issue of the SUPPLEMENT, together with a full description of the mechanical features, such as engines and carbureters, of the winning cars.

The record for mileage by an automobile proper was made by the single-cylinder, 4-horse-power, Orient buckboard which we illustrate. These machines ranked nineteenth and twenty-seventh. They weighed 930 and 920 pounds, and covered 98.8 and 93.8 miles with a cost of running of about 0.876 cent per ton-mile. A Covert, single-cylinder runabout of 1,220 pounds weight made the highest mileage after the winner by covering 73.25 miles. The record for mileage for any machine was made by an Indian tri-car of 1¾ horse-power. This machine weighed 500 pounds with two passengers, and covered 99.8 miles on one gallon of gasoline. This is equivalent to 199.6 miles on two gallons. In other words, one of these machines can be depended upon to carry two people from New York to Boston, at a total cost of about fifty cents, and an average speed of about twenty miles an hour. This is certainly cheap transportation.

As this test was the first which the Automobile Club has held, and as the rules were somewhat tentative, the light-weight cars of one or two cylinders did not have the chance of winning the prizes that they should have had. With the actual results before them, the officials can, no doubt, devise a method of handicapping which will put all cars more nearly upon the same basis. This will make the next contest much more exciting, and much fairer as well.



Single-Cylinder Cadillac Touring Car Which Would Have Won Sixth Place Had It Not Been Handicapped.

Weight, 2,250 pounds. Distance, 55.5 miles. Total pound-miles covered, 124,875. Cost of fuel per ton-mile, 0.646 cent.

A New Method of Stage Lighting.

A Spanish painter, Mr. Marinno Fortuny, proposes an original plan for the lighting of theater stages. At present, the stage receives direct light projected usually by incandescent lamps, or sometimes by arc lamps located in the side-scenes, or in the body of the house. The result is that shadows are projected which, if they do not kill the illusion of the perspective, at least have an effect disagreeable to the eye. For this direct light Mr. Fortuny substitutes diffuse light. The ceiling of the stage is composed of a vault of white cloth, upon which is reflected the light of the voltaic arc from a band upon which is simulated the color of the sky. This band being movable, it is sufficient to paint upon it different scales of color and to cause it to glide under the pencil of luminous rays, to produce a succession of tints as varied and as graduated as we desire. By using at once two or three bands placed at points more or less distant, we could realize upon the celestial vault effects of color unknown to this day. Finally, we might oppose to the rays of certain lamps mirrors upon which we should have painted clouds, which would be themselves projected upon the sky, and the movement of which could be obtained by a simple movement of the mirror. The light thus reflected would envelop the whole stage, the scenery and the characters would be in natural conditions of lighting, and the stage illusion would thereby gain greatly. In theory, the method seems perfectly reasonable. Experience alone will determine us as to its practical value.

The Current Supplement.

How submarine boats observe the movements of an enemy forms the subject of the opening article of the current SUPPLEMENT, No. 1585. The illustrations which accompany the article splendidly elucidate the text. In view of the importance of the subject of locomotive superheaters, Mr. W. F. N. Goss's discussion of the subject will be read with interest. James P. Maginnis's paper on "Reservoir, Fountain and, Stylographic Pens" is continued. Among the miscellaneous articles of interest may be mentioned those on the "Manufacture of Gun Cotton," "The Champagne Industry," and Prof. W. H. Bristol's paper on "A Low-Resistance Thermo-Electric Pyrometer Compensator." Prof. H. H. Turner gives a very clear account of the times and places of earthquakes. The automobilist will read with interest a description of the cars which recently took part in the fuel-economy test held on May 5.

Respiratory Power and Its Limits.

Nowadays, when questions of steerable balloons, airships, and aeroplanes are the *piece de resistance* of many scientific and other journals, the side issue suggests itself with renewed vigor in the form of a vital problem, to wit, to what height can an aeronaut ascend without losing his life? Some twenty years ago experts stated that it was impossible to exceed an altitude of from 26,244 to 29,523 feet. Accidents were likely to occur at 19,683 feet and, after this altitude, the aeronaut becomes insensible. Mr. Paul Bert, however, demonstrated that it was possible to avoid the risk of suffocation at great altitudes by repeated inhalations of oxygen, and it was due to the use of oxygen that some three years ago Messrs. Besson and Suring succeeded at Strasburg in reaching the highest altitude ever attained, viz., 34,770 feet; even then, despite a liberal use of oxygen, one of the intrepid aeronauts fainted.

A few years ago Prof. Musso, of Turin, made some researches in connection with the question of asphyxiation at great altitudes and he came to the conclusion that to enable the influence of highly rarefied air to be successfully combated, it was necessary to inhale oxygen mixed with a strong proportion of carbonic acid.

Mr. Agazzotti, one of Prof. Mosso's pupils, has now just taken up again the experiments commenced by his old master. Instead of making an ascent in a balloon he had himself inclosed in a large bell in which the air, by means of a pump, was gradually rendered more and more rarefied. The bell was provided with a tap, communicating with the outer air, by means of which and a small pump the foul air was expelled. The experimenter then covered his face with a specially constructed mask provided with two valves; one of these enabled the air expired to escape, while the other permitted the inspiration of a mixture of 67 per cent oxygen, 13 per cent carbonic acid, and 20 per cent nitrogen.

When thus equipped Mr. Agazzotti entered the bell and, in half an hour's time, the air was rarefied up to a pressure of 440 millimeters, almost equal to the atmospheric pressure prevailing on Mont Blanc. Mr. Agazzotti seemed to be suffering no inconvenience at this time but, a few minutes afterward (when the rarefaction of the air had reached 360 millimeters), symptoms of asphyxiation were observed. The mixture of oxygen and carbonic acid was now brought into play, and an immediate improvement was noted in the condition of the subject in the glass bell. The pressure was now brought down to 140 millimeters and, more marvelous still, even to 122 millimeters of mercury. On leaving the bell Mr. Agazzotti said to the attendants: "I could have stood a still greater rarefaction, as my memory was quite clear, and my power of movement normal."

As a matter of fact, upon the occasion of a third experiment made quite recently, the rarefaction of the air produced in the bell corresponded to that prevailing at an altitude of 14½ km. (9 miles), thus exceeding by 4 km. (2½ miles) the greatest altitude ever reached by man—even in a practically semi-conscious condition. The experiments made by Mr. Agazzotti, therefore, show that with the use of the mixture prescribed it will be possible for the aeronaut of the near future to render great services to science at large.

Artificial Solar Eclipses.

The following description of an apparatus for artificial eclipses of the sun is given by C. André in Comptes Rendus:

A small occulting disk is fitted in a slide near the eyepiece collar of an astronomical telescope, driven by clockwork, so that observations may be made of the solar disk when occulted to various degrees by the artificial screen. The practice thus obtained facilitates the taking of measures of the varying geometrical figures presented during a real solar eclipse. Imitations of partial or total eclipses are regulated by adjustment of the occulting disk.

The new regulations concerning the introduction of cars into Holland, for a temporary visit, are now in force. According to the Automobile Club Journal, no customs deposit will, in the future, have to be made if the visit does not exceed eight days, and the customs officials are empowered to issue temporary permits to visitors, available for the period mentioned. Cars bearing foreign numbers do not have to carry special Dutch numbers. It will be remembered that the speed limit, which was at times rather needlessly enforced in Holland, has, by the new law, been abolished, the only offense now being "driving to the public danger."

A NEW MACHINE FOR ENGRAVING STEEL PLATES.

(*Continued from page 412.*)

Supported by the cross-bar which connects the two standards, *B*, is a screw-feed mechanism and a guide parallel with it. Moving upon this guide, and controlled by the mechanism, is a traveler from which is suspended, by means of a universal bearing, the oscillating transmitter, *a*; the lower end of the transmitter is similarly connected to the arm, *b*, carrying the stylus or tracing tool, *c*, which is adapted to follow the lines of the original or pattern. The transmitter is provided with a central slot, one side being graduated, to facilitate the ready adjustment of the link connecting it with the work-bed, and so enable a speedy regulation of the desired scale of reproduction by the operator. The arm extends toward the operator, and to this is rigidly attached a side arm carrying the tracing point; this side arm is fitted with a ball and socket joint to the lower end of the rod *d*, the upper end of which is similarly fitted in a bracket. The latter comprises a curved arm extending from and carried by the traveler, the object of the rod being to serve in conjunction with the transmitter to keep the arm from turning and to consequently prevent any lateral tilting of the stylus. Mounted on the arm, *b*, is the swiveling frame or pantograph mechanism; it is held in the proper position by a cone bearing, a thrust bearing, and a set-nut, while the opposite sides of this frame are provided with point bearings. Mounted between these bearings, and in alignment with the side-arm, is the lower portion of the transmitter. The upper bearings comprise a frame mounted between point bearings in the traveler, the frame comprising three parallel arms adapted to pass on either side of and through the slot of the transmitter. Between the outside arms of the frame, which also has point bearings, is mounted the upper end of the transmitter; by means of these arms and bearings it will be observed that a universal movement of the transmitter is secured, the motion of which is transferred to the work-bed.

In the operation of the engraving machine, the original or pattern letters are firmly secured to the table beneath the stylus, the arrangement adopted, by which the letters are made interchangeable, being shown in the photograph. Assuming by way of illustration that a letterhead is to be engraved, then the name of the individual or corporation is set up from previously cut letters of large size and clamped to the support. A blank steel plate is then securely attached to the work-bed by means of suitable clamps. Having previously determined on what scale the original or pattern is to be reproduced, the lugs are released and the sleeves are thus permitted to move on the vertical guides; the arm is then swung out, so that the longitudinal adjustment of the transmitter can be made.

The rack-and-pinion mechanism is then actuated to raise or lower the crosshead; the work-bed and the supporting mechanism thereby reduces or increases the scale of reproduction as desired. The transmitter is provided with a scale, so that it can be determined when the correct position of the clamp has been secured. When all the adjustments have been made, the treadle is then pressed and the carrier is pulled downward until the stop comes in contact with the abutment.

To permit the use of the treadle, the screw is reset, and the routing tool having been brought into position so as merely to touch the plate, the treadle is released and the micrometer is set so as to move only with the stop; when the micrometer registers the desired depth of cut, it is held by a set-screw. Everything is now in readiness to proceed with the engraving of the plate. The stylus, as in an ordinary pantograph, is caused to follow precisely the line of the original letters or patterns, while the routing tool reproduces these, cutting them into the steel plate with mathematical precision.

A Waste Product.

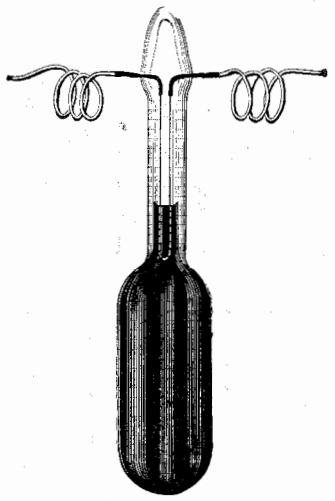
Certain wooden cylinders, usually from 30 inches to 50 inches long, and from 6 inches to 7 inches in diameter, have become quite common in some places in Florida. They are called veneer cores, and are the waste lumber from the cutting of material for the sides of orange boxes and for other crates. This veneering, most of which is pine, is cut by clamping the ends of the sections of the log to spindles, and revolving the logs rapidly under sharp heavy knives. After the bark is off, the knives are sunk into the wood and thin sheets are pared off, unrolling somewhat as paper does from a roll. These are conveyed on runners under drop-knives, which fall at regular intervals and cut the veneer pieces of the right size for the crates. The cores are the heart-pieces that are left after all the log that is available for crate material is cut for veneering. These cores are used for various purposes, to some extent for fence posts, but most of them for fuel, and are found on many Florida woodpiles. There are several veneer-cutting mills in Florida.—Building News.

A THERMO-ELECTRIC PYROMETER OF LOW RESISTANCE AND COMPENSATOR.

This improved electric device for reading high temperatures has been devised by Prof. William H. Bristol, of Stevens Institute. It is designed for use in all kinds of commercial work. Prof. Bristol states that it is similar in principle to the Le Chatelier pyrometer, but it is of low resistance, and instead of the extremely delicate suspension galvanometer, a Weston special dead-beat milli-voltmeter is used. In place of the costly platinum-rhodium elements, inexpensive alloys are employed for the couples.

The low cost of the couple makes it possible to keep an extra one on hand for use as a standard for quickly and easily checking the one that is in regular service.

The temperature at a number of localities may



THERMO-ELECTRIC COMPENSATOR.

readily be observed on a single instrument, a couple and leads being provided for each locality in connection with a suitable switching device.

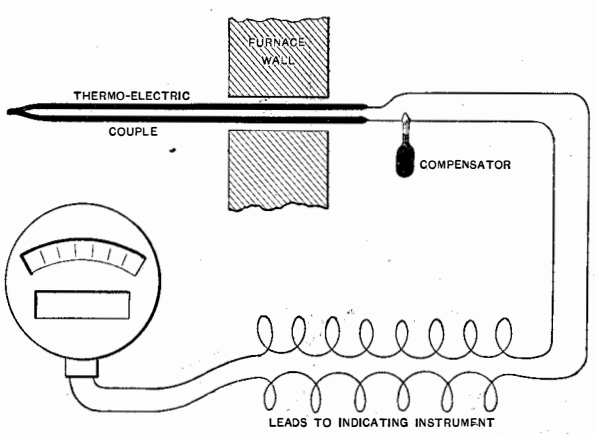
The same instrument may also be provided with scales for different total ranges.

For ranges of temperature up to 2,000 deg. F., instead of using porcelain tubes for insulation, each element of the couple is insulated with asbestos and a carborundum paint. Couples so insulated may be applied directly to the fire space where the temperature is to be measured, or, where extra protection is desirable, the couple may be slipped into a piece of common iron pipe with one end closed. Couples so protected are well adapted for use in liquids and molten baths, such as are employed for hardening and tempering of steel.

For instantaneous determination of the temperatures of molten metals as brass, bronze, etc., the ends of the couple are left disconnected and without insulation.

The same form of the couple may be used for quickly measuring the temperature of a metallic object. For this application the tips of the couple are pointed, so that the temperature at the two points of junction may become the same as that of the object immediately after the contact is made. This form of the couple affords a most convenient method for almost simultaneously measuring the temperature at different points of an object.

When desirable the couples are made with a separable junction, which permits the fire-end to be removed and renewed at pleasure.



THERMO-ELECTRIC PYROMETER, COMPENSATOR, AND VOLTMETER.

A compensator is adapted automatically to correct for atmospheric changes of temperature at the cold ends of the couple.

In order to make an equivalent and to reduce the cost of the platinum-rhodium couple for the measurement of temperatures above the fusing point of the low-priced alloys, a compound couple is formed with platinum-rhodium for the part to be exposed to the full temperature to be measured and of a length extending to a point where the temperature will not exceed 1,200 deg. F. The remaining portion of the elements of the couple is composed of inexpensive alloys.

Automatic continuous records of the indications of the pyrometer may readily be made on a chart sheet which is arranged to move at the proper speed back of the end of the indicating arm. This record sheet is unsupported over its active portion, which is periodically vibrated by the clock movement into contact with the end of the indicating arm and produces a record upon the chart sheet.

The record may be made by ink carried by the indicating arm, or the surface of the record sheet may be coated with some easily removable substance.

For automatically recording rapid changes of temperature a current from an induction coil may be passed through the record sheet from the end of the indicating arm at frequent intervals.

The idea of the pyrometer is, when heated, the generation of a weak current of electricity, which passes through a compensator on its way to the milli-voltmeter also in the circuit, the degree of heat being indicated on the voltmeter. The compensator equalizes what is termed the cool ends of the pyrometer away from the heat, and keeps their potential of resistance equal by the expansion upward or falling, as the case may be, of a column of mercury, which short-circuits the loop of wire passing down through it. The device avoids the need of making allowances for the cool end variations, and is very simple and effectual.

The illustration shows the thermo-couple inserted in a furnace, the position of the compensator and the circuit leading to the voltmeter. The apparatus indicates perfectly the slightest changes of temperature.

Hollow Concrete Building Blocks.

Single blocks are made as large as 8 feet long, and 8 inches wide, and 10 inches thick, reinforced by steel rods. This tends toward concrete beam construction, though used as lintels. Blocks are rarely made longer than 6 feet without reinforcement. Single-piece hollow blocks are made 20 inches to 32 inches long by 8 inches, 9 inches, and 12 inches, other dimensions, to make the full thickness of the wall. Two-piece blocks are made, as the name implies, for face and back wall. An argument in favor of the single-piece block is that when laid in place a section of the wall is completed, requiring no bonding to the front, containing 30 per cent air space generally; more material and strength, therefore better and more economical than two-piece system. Advocates of two-piece system claim to secure a drier inside wall, with less material, having 50 per cent air space, and present a more even inside wall upon which to plaster.

Following are a few of the proportions of materials used by different makers of blocks:

1	cement	4	sand.	
1	"	4	"	and gravel.
1	"	5	"	
1	"	2	"	4 cinder.
1	"	1	"	2 crushed stone.
1	"	3	"	
1	"	2	"	

Sometimes used as facing blocks, with the view of rendering the blocks more impervious to moisture, but that seems unnecessary, as the concrete becomes practically waterproof when set, thoroughly crystallized. After the materials are mixed dry, water should be added from a sprinkling can till the mass is of a uniform color and sufficiently wet to retain shape when squeezed in the hand. The quantity of water required will vary with the condition of the sand and percentage of humidity in the atmosphere. Shovel the mixture into the mold in small quantities, meanwhile constantly tamping. Remove the block on the pattern to a place under cover, where it shall remain for at least one week (two weeks shows greater strength); sprinkle the block next morning, and twice daily for one week, when the block may be safely used in building.

Artificial Wood from Peat.

Frequent attempts have been made to use peat as raw material for the manufacture of artificial wood. The material must, for this purpose, be fully reduced to a fibrous condition, so as to produce a fibrous and a mealy mass. This mixture is mixed with an emulsion of 2 parts by measure of plaster of Paris and 10 to 12 of water; and is subjected for considerable time to heavy hydraulic pressure in molds, then artificially dried, polished, and oiled, painted, or varnished.

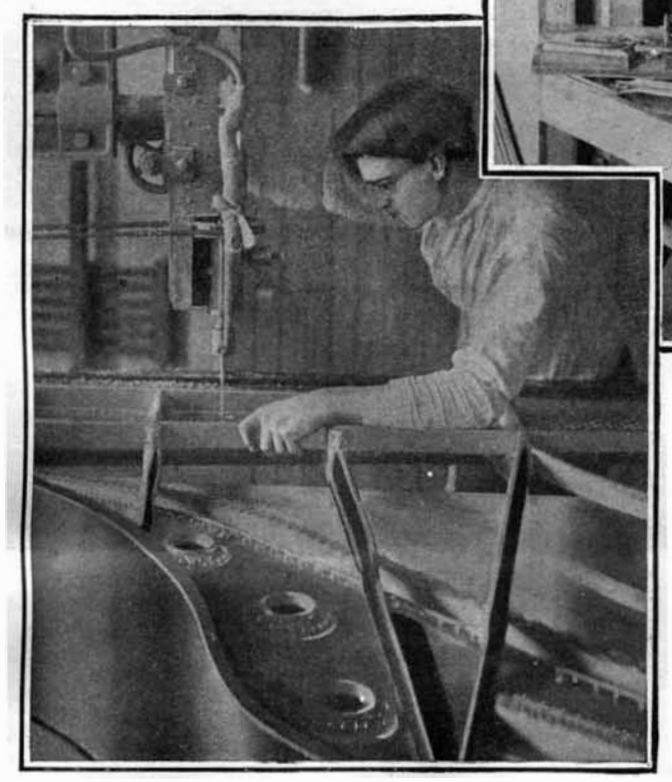
A more simple process is to wash the peat, without destroying its natural fibrous state, and to mix the resulting moist mass with a mixture of hydrated lime and an aluminium compound (as for instance aluminium sulphate) and press it in molds for a short time in the moist state, after which the resulting plates are allowed to harden in the air. The resultant product needs only a comparatively low pressure, and this for only a short time; and is then set out to dry in the air. The resulting artificial wood is not hygroscopic, and in order to use it for open-air work needs no painting or further impregnation. In view of the fact that the pressing operation takes only a few minutes, considerable quantities can be manufactured in comparatively small space and time.

THE ART OF PIANO MAKING.—I.

In an age in which the old handicrafts are being rapidly swept out of existence by the invasion of labor-saving machinery, it is gratifying to find, here and there, an art, such as that of piano-making, which demands for the creation of its finished products the sensitive and sympathetic touch of the human hand.

The SCIENTIFIC AMERICAN has chronicled, from time to time, some wonderful triumphs of the labor-saving machine—notably its almost complete mastery of the delicate art of watch-making, in which it has succeeded in rivaling the finest handmade products of European handicraft; but in the present article, which is devoted to the making of the high-grade piano, we find ourselves in a field where the skilled artisan still reigns supreme, and is likely to so remain to the end of time.

It is a significant fact, taken in this connection, that the absolutely first-class piano firms in the United States are of old standing, and embody in their products a wealth of experience and shop traditions which, in itself, is no doubt one great secret of the high quality of the output; and this is essentially true of the Knabe Company, of Baltimore, the construction of whose piano forms the subject of the present article. The original works were built as far back as the year 1837, and the secrets of manufacture, the thousand-and-one shop "wrinkles," have been handed down from father to son, in the ownership, the management, and at the bench through three generations.

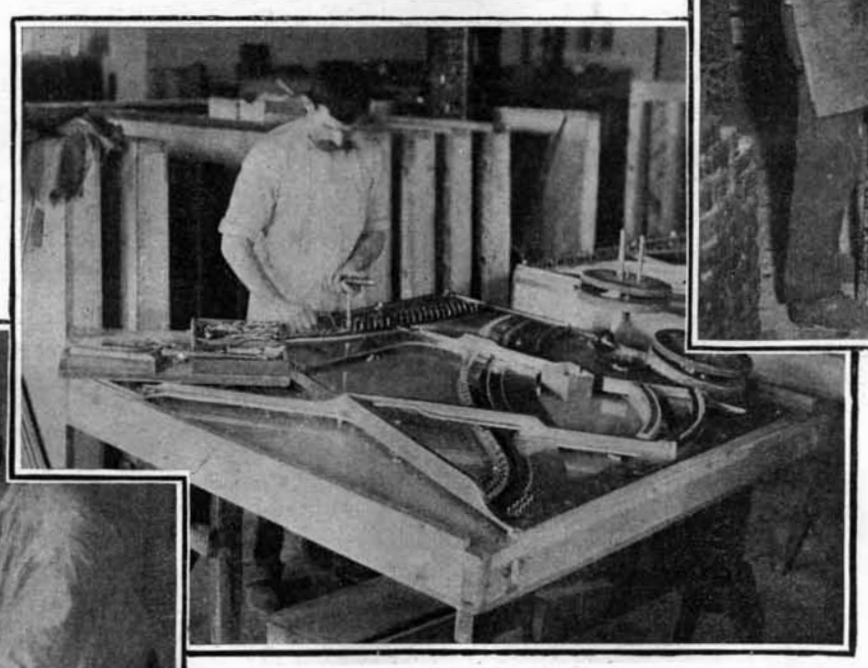


Drilling Holes for Tuning Pins in the Plate of a Grand Piano.

SELECTION OF THE WOOD.—There is, perhaps, no other object of manufacture in which the production of the desired effects is so little dependent upon one single element of the instrument, and so completely dependent upon the combined effect of all the elements, as in the high-grade piano. Thus, in the instrument under consideration, the primary object aimed at is to secure the characteristic singing tone for which it is famous. To this end the various kinds of wood—spruce, pine, maple, oak, mahogany, etc.—are carefully selected with a view to their resonant or singing quality. Each piece of lumber in the rough is struck to determine if it has the proper ring; its texture must be of a certain quality; its grain true and straight. Great attention is paid to the seasoning of the lumber, which upon its delivery at the works is stacked in the stockyard, where it is weather-seasoned for from two to six years before it is available for use in the shops.

THE WOOD MILL.—The seasoned lumber is first taken to the wood mill, where it is sawed into widths practically all of which are less than 6 inches, and many of them from 2 to 4 inches in width. From these small widths are built up the various larger members that enter into the piano, such as the legs, the heavy posts of the frame, the delicate sounding board, and the various sections of the case. The object of this process of building up, which is done entirely with glued joints, no metal whatever being used, is twofold. First, to so arrange the grain in the contiguous pieces of wood that the atmospheric changes shall have no warping effect upon the piano; secondly, to secure that harmonious arrangement of the grain of the wood which it has been found conduces so greatly to the tonal effects in the piano. It may be a surprise to many of our readers to learn that the resonant character of the wood in the case and even the legs of a piano can have its share in the final tone result; but this is a fact.

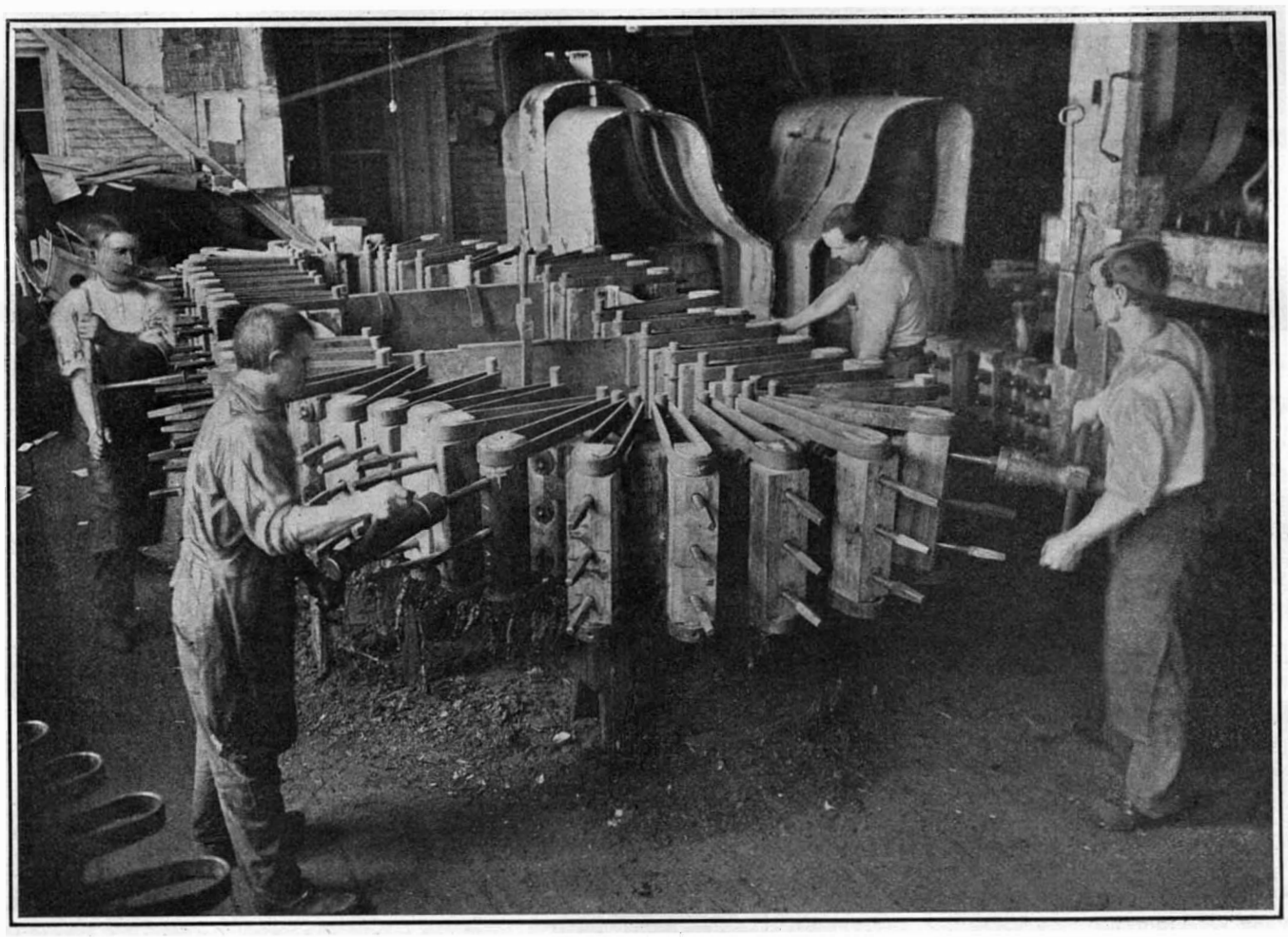
Japanning Room Showing Entrance to Oven.



Stringing the Rast.

THE "RAST" OR FRAME.—The massive wooden frame which forms the back of the upright piano, and the base and sides of the grand, known technically as the "rast," is the foundation to which the whole system—sounding board, plate, pin-block, and strings, is attached. It assists the metal frame in taking the strain of the strings, which may aggregate from 25 to 40 tons, and by its intimate connection with the sounding board assists in securing the desired resonant qualities. In the Knabe piano each of the posts of the upright is built up of several carefully selected pieces of material. The whole frame is securely glued together, not a single bolt or screw being used. At its upper end it carries the pin-block or tuning block, a horizontal member built up of four layers of hard rock maple glued one upon the other, with the grain of the layers running in alternate transverse directions. After the rast has been glued together in the rough, it is placed upon the horizontal table of what is known as a "frazing" machine, a vertical rotary planer on which the rast is rapidly planed down to its finished dimensions. As will be seen from the accompanying illustration, the edges of the rast are moved past the cutters, the depth of cut being regulated by stops along which the work is guided by the operator.

The grand rast, as will be seen from our illustrations, is of an entirely different form and construction from the upright rast. Like the former, its strength is largely derived from a series of stout posts or columns, arranged in the same plane; but in this case, instead of standing parallel with one another, they radiate from a common center and butt against the curved, outside, vertical wall of the rast, against which they are securely fastened. The outer frame has the peculiar curve characteristic of the exterior shape of the grand pi-



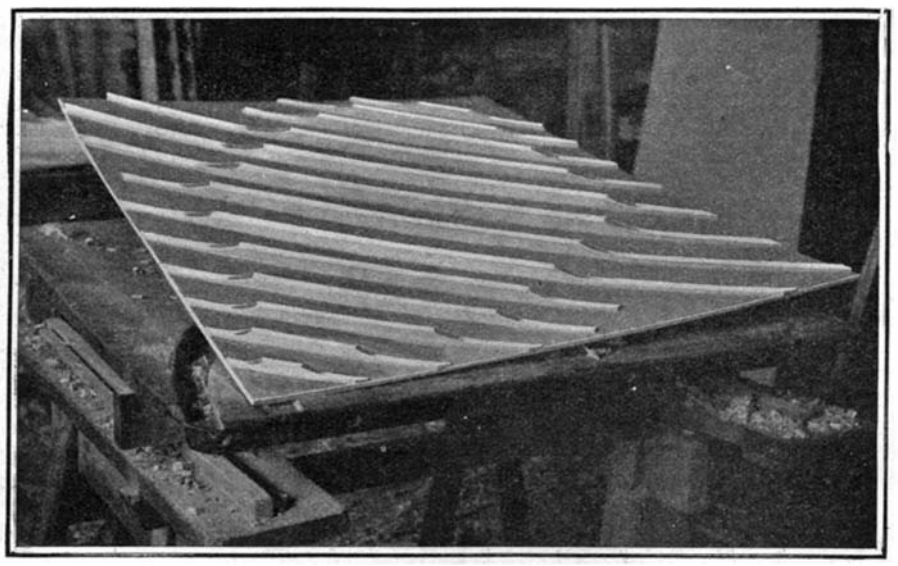
Glueing Together the Rast of a Grand Piano.

ano, and the very greatest care is taken in the selection of its material and its building up into the desired shape. Although it is from 4 to 4½ inches in thickness, it is not made from one solid piece, but is built up of from 16 to 28 thicknesses of 3/16-inch sawed soft pine, the pieces being selected for their texture, grain, and resonant qualities. The material is assembled, bent to the desired form, and thoroughly glued together, being held in place by a large number of hand clamps, in the way that is shown in our interesting photograph illustrating this process.

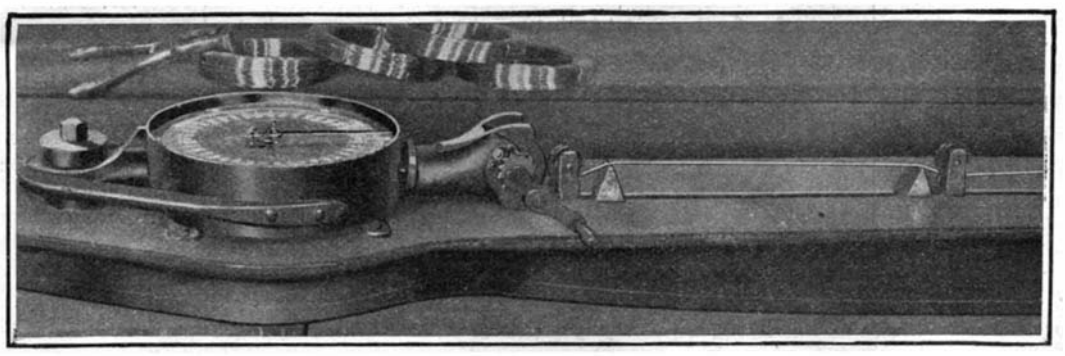
THE SOUNDING BOARD.—Outside of the strings, and perhaps not even excepting them, the most critical element in securing the rich tone of this piano is the sounding board, which has been aptly termed the soul of the piano. The function of the sounding board is to increase the area of vibrating surface which is in contact with the air. The piano strings alone have too little surface to sufficiently condense and rarefy the air to affect the auditory nerve. In the simple string, the vibratory surface is simply the diameter multiplied by the length; but by having the sounding board connected with the strings through the bridge, the vibrations of the strings are communicated to it, and because of its large area the vibrating surface is increased many thousand fold. The building up of a sounding board is a continuous process of selection. Two pieces of apparently similar wood may have a wonderful difference of tone; for the sound is transmitted more freely in highly elastic wood. Sounding-board lumber should be very elastic with a view to its producing vibrations with a minimum expenditure of power. If it be not so, the vibrations are lost in the production of heat; the tone soon dies away, and loses that singing quality which is a distinguishing characteristic of the Knabe piano. The sounding board is made from carefully selected spruce pine, and the quartered wood is cut so that the "season rings" run at right angles to the grain of the wood.

As the result of the high elasticity of the season rings, the board presents a surface which responds to the most delicate impulses of the sound waves. It is built up of strips that run in a diagonal direction, and vary from 3 to 4 inches in width. Those strips which have a wide grain are placed opposite the base strings, those with the closer grain opposite the treble. The board, as glued together in the rough, is about one-half inch thick, and it is planed and sandpapered down to a finished thickness of from about a quarter in the bass to three-eighths of an inch in the treble end.

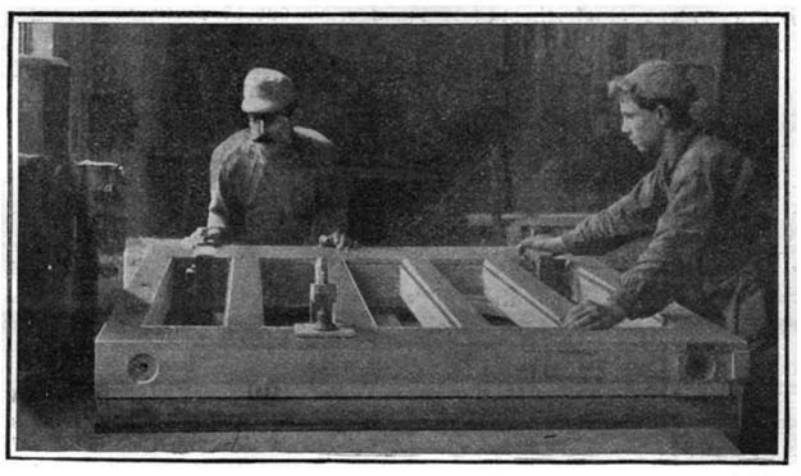
The selection of the wood, and the arranging of it according to its grain and other qualities in the built-up board, is considered at the Knabe works to be, perhaps, the most important art in all of the many departments. The specialist who does this work represents the third generation of a family that have been engaged for the past seventy-five years in doing nothing else. The sounding board is strengthened on its back by a series of parallel pine battens or ribs, glued firmly on, which also serve to give the correct curve to the board. To produce this curve, which is rather complicated in form, so that the bridge (a maple strip measuring 1 inch by 1⅛ inch, and running diagonally across the board from treble to bass end) shall lie everywhere along its highest point, is a most important feature in the production of the sounding board. After it has been carefully planed and sandpapered, during which process it is given no less than seven inspections, the sounding board is glued down upon the rast, and held in place by means of covering strips along its edges.



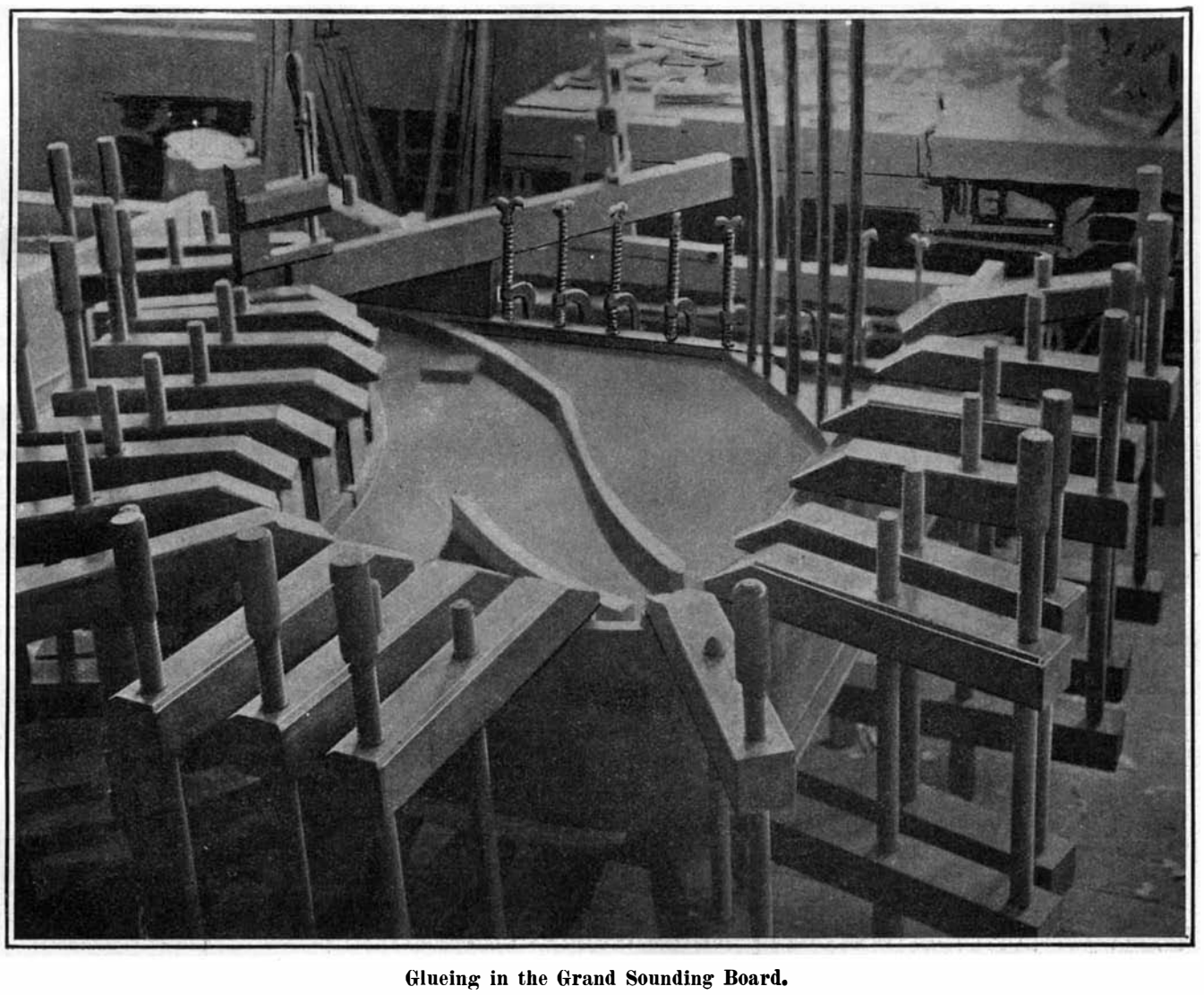
The Sounding Board, the Soul of the Piano.



Sonometer for Testing Piano Wire and Determining the Tension Necessary to Bring the Strings to Pitch.



Frazing Machine, on Which the "Rast" or Frame of Piano is Planed to Finished Dimensions.



Glueing in the Grand Sounding Board.

THE PLATE.—Above the sounding board, and extending over the whole width and height of the rast, including the pin-block, is securely fastened down by bolts and set screws what is known as the "plate," a strongly-ribbed, carefully-designed casting made of a special iron alloy, which has to perform the important function of carrying along its lower end the pins upon which the strings are strung and of bracing at its upper end the pin-block into which the tuning pins are driven. In addition to performing its principal function of presenting a reaction to the tremendous aggregate tension of the strings, amounting to the enormous pull of 25 to 40 tons, the plate serves to hold the whole fabric of the piano to true line and surface.

The company make all of the castings required for their pianos—the most important of them, of course, being the plates. The rough castings are smoothed down and chipped to bring them to the smooth surface which characterizes the plates, and are then taken to the plate department, where the hundreds of holes required for the pins, tuning pins, and fastening screws are drilled by templates—a work which requires the greatest accuracy. The work is done in special drilling machines, the plates being placed on tables, with a universal movement for speed and facility of handling. The finished plates are then bronzed and japanned, an illustration of the latter operation being included in the photographs.

THE STRINGS.—Although, as we have shown, the final tone of a piano is secured as the result of careful design in every element of the instrument, the strings or wires are essentially the sound-producing mechanism, and no part of the piano calls for more thoughtful design and careful construction than this.

The wire used in the first-class piano is of a highly-specialized grade, the best of which is manufactured in Germany. It must have a very high

coefficient of elasticity, the elastic limit being close to the breaking point, and much greater than the tension put upon the strings during the operation of tuning. Secondly, it must be of uniform diameter and uniformly round in cross sections, otherwise the over-tones to which is due the tone quality will not be perfectly secured; thirdly, it must have permanence, that is to say, it must not stretch under continued stress.

The number of vibrations per unit of time, corresponding to the fundamental tone produced by a string, varies inversely as the length of the string, inversely as the square root of its weight, and directly as the square root of its tension. If a wire be stretched between two points *A* and *B* (see accompanying diagram), and plucked or struck, it will vibrate above and below the line *A B*, giving what is known as a fundamental tone. This fundamental tone is without character, and would sound the same in all instruments, so that one could not distinguish whether it came from a violin or a piano.

In addition to its fundamental vibration between its points of attachment, the string undergoes a series of sub-vibrations, above and below its own normal curve, which it will pass at certain points, "nodes," dividing it into equal parts. Thus, in the accompanying sketch, *A*, *C*, *B* and *A*, *D*, *B* represent the fundamental vibrations, and *A*, *E*, *C*, *F*, *B* the first sub-vibration intersecting the fundamental vibration at the node *C*. Again, the string may vibrate in three parts, four parts, five parts, etc. The production of the proper sub-vibrations, and the determination of their power relative to the power of the fundamental vibration, constitutes one of the most abstruse problems in the art of piano making; for the effect of the sub-vibrations is added to the effect of the fundamental vibration, and their total effect is heard in the distinctive quality or "tone color," as it is called, of the instrument. The sub-vibrations are known as the upper partials or over-tones, and generally speaking, they are harmonious with one another and with the fundamental tone.

The over-tones which correspond to the division of the string into seven or nine aliquot parts, however, are inharmonic, and in order to destroy them the hammers are so placed that they will strike at one-eighth of the length of the string. The width of the striking surface of the hammer is sufficient to intercept and dampen out the seventh and ninth upper partials, leaving only those which are harmonic. In the accompanying diagram, the sinusoidal curve representing the condensation and rarefaction of the air produced by the fundamental tone is shown by a heavy dotted black line, and the effect produced by the first, second, and third upper partials by fine lines. The effect of the latter upon the fundamental is to produce the irregular heavy final curve, which is shown here by a heavy black line. It must be understood that three only of the upper partials or over-tones are shown, whereas they may run up to the thirty-fourth or thirty-sixth, all tending to give fine quality to the resultant tone.

In laying out the "scale," a certain standard tension (in the Knabe piano about 141 pounds) is adopted for all the strings, and it is invariable. The variable elements are the weight of the wire and its length. The scale starts in the treble with a short length of about 55 millimeters, and if the same weight of wire were used throughout, the lowest bass strings would have to be 32 feet in length, which is, of course, impossible. The piano builder chooses, therefore, the greatest length of bass string compatible with the size of the piano which he intends to build, and then to obtain the correct pitch, he winds on a sufficient weight of copper or other wire to reduce the pitch to the proper standard. The number of vibrations varies from 26 per second in the lowest bass string, to 4,136 in the highest treble string per second.

(*To be continued.*)

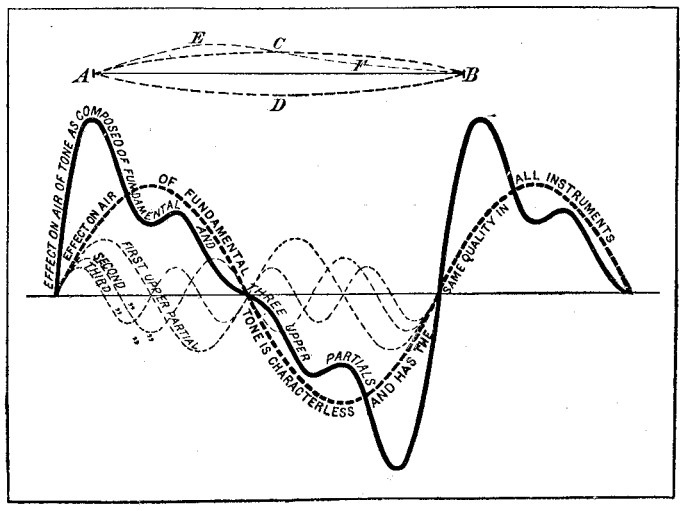


Diagram Showing Effect of the Upper Partials in Modifying the Fundamental Tone.

EARTHQUAKE OBSERVATIONS.

BY PROF. EDGAR L. LARKIN.

A cemetery filled with monuments, columns, and obelisks is a capital place to study the effects of an earthquake. Amplitudes and azimuths of disturbed monoliths and pillars reveal at once the action of the earth upheavals. I had no instruments with which to measure, so had to make estimates.

Laurel Hill Cemetery I found a field of distorted, shifted, turned, cracked, overthrown, and ruined columns, pillars, shafts, capitals in white marble, gray granite, and other materials. Angels' wings were broken, sculptures were round about, and heavy bases were twisted out of their original positions. At first I noted distortions on both sides of an avenue of tombs. Here are directions in which the tops of fallen columns and monuments were pointing along either side, in a distance of 150 feet: N. 1, S. 2, E. 9, W. 5, N.E. 4, N.W. 5, S.E. 5, S.W. 6. From this I thought that the chief distortion was toward the east. Then facings of those that were skewed around on their bases, but not overthrown, were noted, as follows: N. 1, S. 1, E. 2, W. 1, N.E. 4, N.W. 0, S.E. 2, S.W. 1. All these had been twisted around against intense friction at their bases. The one marked N. originally faced eastward, and the one shown as facing S. once faced westward. I examined many others, hoping to make order out of chaos, or find a general trend in direction, but could not. The conclusion reached was that the monuments were thrown over and twisted in every direction.

The Oddfellows' Cemetery was explored. This is more modern than Laurel Hill; the monuments are higher and heavier. They were fastened down by lead in some cases. The most complete confusion reigned. The displacements likewise were in every direction. An observer with instruments, upon making surveys during a month, might find a majority of fallen columns pointing one way, or facings, but it is doubtful. The earth's surface surely moved in every direction. As nearly every brick and stone building was destroyed, they could not be studied. The great Fairmount Hotel has rents in the corners, and several high up, along near the middle of the façades. The new $5,000,000 post office is torn near the corners. The towering steel and stone Spreckels Building stands as a skeleton, but looking down on a wilderness of ruins of all old-type buildings. For the new city will be erected around ribs of rigid steel. The accompanying diagrams show roughly the distortions in the cemeteries. The line N.S. is due north and south, in cuts Nos. 1 and 2. Twistings of obelisks that did not fall range from five to seventy degrees in all directions from their original foundations. My impressions gained in the cemetery were confirmed upon receipt by mail of the seismograph shown on page 419. It was sent me by F. M. Clarke, steward and executive officer of the California Veterans' Home, Yountville, Napa County. My thanks are hereby extended to him for the faithful record. It indeed shows that the ground moved in every possible direction. On leaving the cemetery I wrote an article for the papers, saying that it was a circular disturbance, and the graph reveals a circle near the center. Mr. Clarke says: "The first movement had a N. and S. direction, but was swiftly compounded with a circular, twisting movement, accompanied with severe upward thrusts. The first movement was decidedly wave-like; then a cessation, followed by the severe twist." Napa is 45 miles north of San Francisco, and San José, 50 south. Both were destroyed.

Mr. Edward Pickersgill, Alameda, Cal., sends me a series of photographs of great upheavals, distortions, and displacements of the ocean shore, four miles from Colma. Vast banks of sand slid into the sea, and a new high point of land was formed as shown on page 419. A place where gas escaped from soft mud is also shown. The soil is a foot or more high, and six wide.

Without doubt, gas had to do with the great earthquake. Newspaper reports say that from April 18, 5:18:57 A.M., to April 26, 3:15 P.M., thirty-two shocks left their imprint on the seismograph at Berkeley, and that twenty-six occurred on the first day, the 18th. I felt the sharp shock that came on the 20th, 4:34:17 P.M., in a three-story frame building. It was my fourth earthquake. The priceless collection in the magnificent Lick Academy of Sciences vanished. All the replicas of historic, paleontological and geological finds were consumed; also early Spanish records of exploration. The great libraries and many private collections of literary treasures exist only in cherished memories.

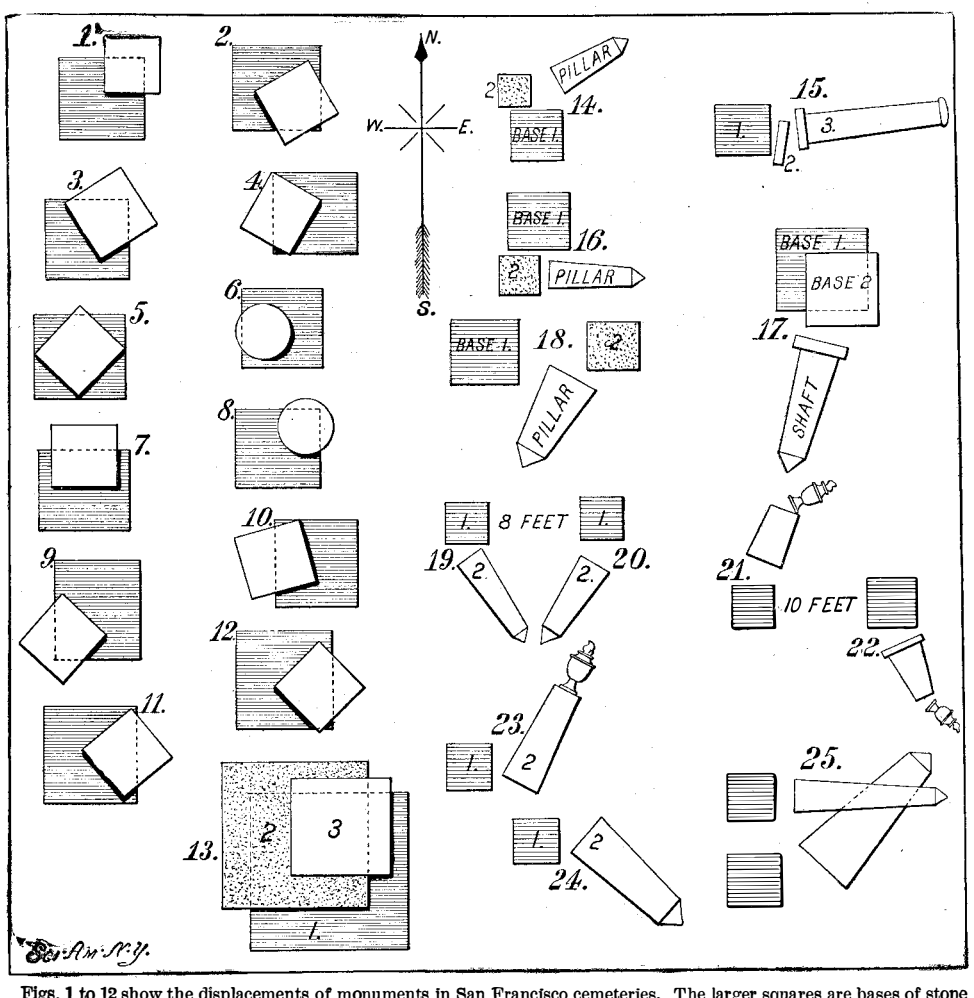
Mt. Lowe Observatory, Cal.

EFFECTS OF THE EARTHQUAKE AND FIRE UPON THE CITY OF SAN FRANCISCO AND ITS BUILDINGS.

BY ARTHUR INKERSLEY.

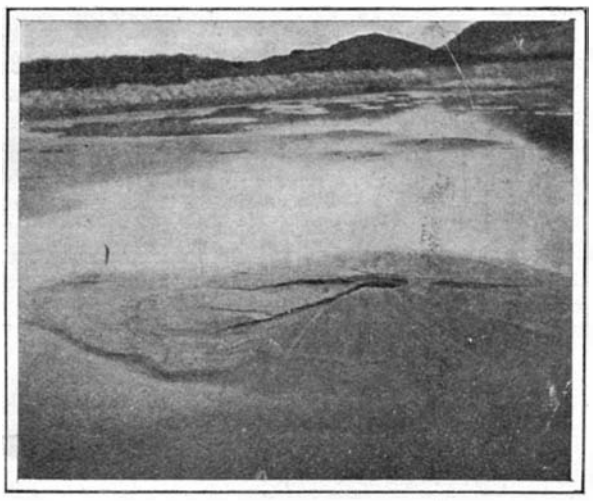
About ten days after the San Francisco earthquake, which occurred at 5:13 on the morning of Wednesday, April 18, the city engineer sent out three parties for the purpose of ascertaining whether or not the whole city had sunk as a result of the shock. Many places were found where the ground had sunk considerably; especially on Valencia Street between 19th and 20th Streets, at the easterly end of Market Street near the ferry depot, on Howard Street between 17th and 18th Streets, on Van Ness Avenue from Vallejo to Green Streets, and on Folsom Street near 17th Street. The sinking is almost wholly on made ground in the lower parts of the city. At the southeast corner of the United States post office on Mission and Seventh Streets, there is a depression and a corresponding raising up of about four or five feet. That part of the post office was built over an old swamp. The building retained its position, but the concrete sidewalk pulled away from it, leaving a gap of six to ten inches. The city engineer's conclusion is that the city as a whole did not sink. There was no distinct subsidence of any considerable portion of the peninsula.

The disturbance of the earth's crust on Wednesday morning, April 18, in San Francisco and its vicinity was really inconsiderable. The vibration was sufficiently great and sustained to shake down chimneys, bad masonry, and old frame buildings on rotten or insecure foundations. According to Prof. O. A. Leuschner, of the astronomical observatory of the University of California at Berkeley, Alameda County, the damage caused would have been vastly more serious had the vibrations not been distributed over so many seconds. If the shocks had been instantaneous, very much greater ruin would have resulted. The standard clock of the students' observatory stopped at 5:12:38 A.M. Pacific time, some less severe temblors being recorded at 5:12:03. The earthquake came chiefly in two shocks, the first series of vibrations



Figs. 1 to 12 show the displacements of monuments in San Francisco cemeteries. The larger squares are bases of stone resting on the ground. The smaller squares and the two circles (Figs. 6 and 8) are bases of high monuments. The greatest shifting measured was 10½ inches. The lateral movements appear to have been in all directions. Fig. 13 shows a double displacement of two bases and monument. The square 1 is a large granite base; the square 2 is a second stone upon which the column 3 rested. Figs. 14 to 25 indicate the positions of overthrown monuments. The two low monuments with urns (Figs. 21 and 22) could not have been thrown by the same oscillations of the earth.

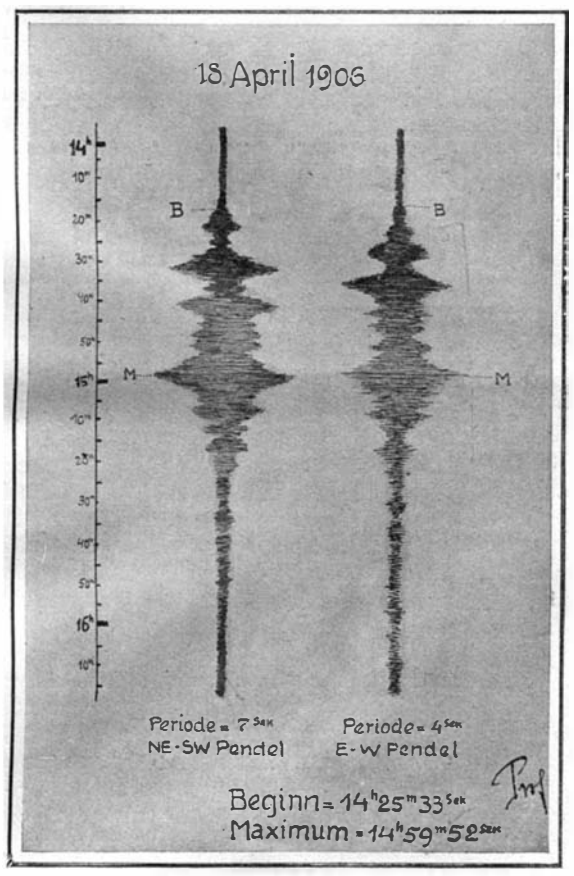
CEMETERY MONUMENTS OVERTHROWN BY THE EARTHQUAKE.



Blowhole on Beach Near Colma. There Was No Sign of Water Here Before the Earthquake. Mounds Were Formed Five and Six Feet in Diameter and One Foot High.

lasting about forty seconds; then diminishing in force for ten seconds; the second series lasting more strongly for about twenty-five seconds. The direction was mainly from S.S.E. to N.N.W. The remarkable feature about it was its rotary motion. The sum total of all the displacements represents a very regular ellipse, and some of the lines that indicate the movement of the earth's crust can be traced along the entire circumference. The slowness of the vibration was the saving feature of the visitation.

The most severe recorded earthquake that preceded

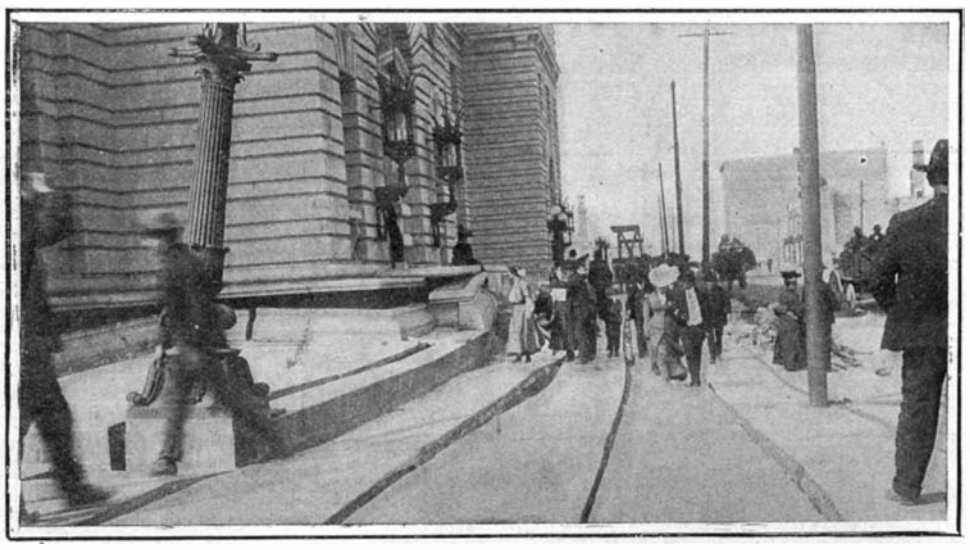


Record of San Francisco Earthquake Made at Austrian Imperial and Royal Seismological Observatory of Laibach.

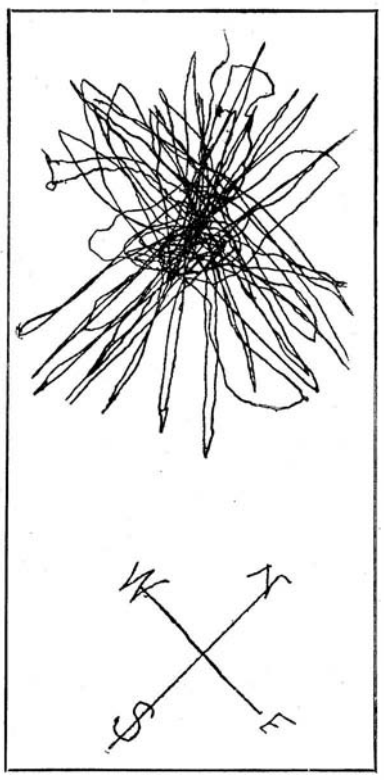
the one of April 18 occurred in San Francisco on October 21, 1868. The direction of that was northerly and southerly and its duration was 42 seconds. A second shock, lasting five seconds, came later and was succeeded by several lighter and shorter tremors at intervals of about half an hour for three hours. The first shock was felt most severely in the eastern part of San Francisco on the filled-in ground between Montgomery Street and the bay. No serious damage was done to well-constructed houses built on solid ground. The custom house, a poorly-constructed building on bad ground, suffered severely, and a small fissure opened on Howard Street. The tall chimney of the United States mint was damaged, and a ferry steamer near Angel Island felt the shock strongly. Waves came fifteen or twenty feet farther inland than usual. A dozen shocks were observed, the prevailing direction being from S.S.E. to N.N.W. Not one well-built house, whether of stone, brick or wood, on solid land, was damaged seriously. The actual displacement of the earth's crust was about half an inch, and the velocity during the heaviest shocks was, roughly estimated, two inches per second.

Prof. Burkhalter, of the Chabot Observatory, Oakland, Cal., says that earthquakes are divided by scientific men into ten classes, according to their intensity, and that the earthquake that visited California on April 18 belongs to class 9. He says that during the disturbance of its equilibrium the earth moved in every direction, but the general motion was rotary; that the strain on the earth's crust that caused the earthquake of April 18 had been growing for half a century, or perhaps for a whole century. It is likely, though no man can tell, that there will be no more serious disturbances for a long time.

The net result of a century's study of earthquakes is that,



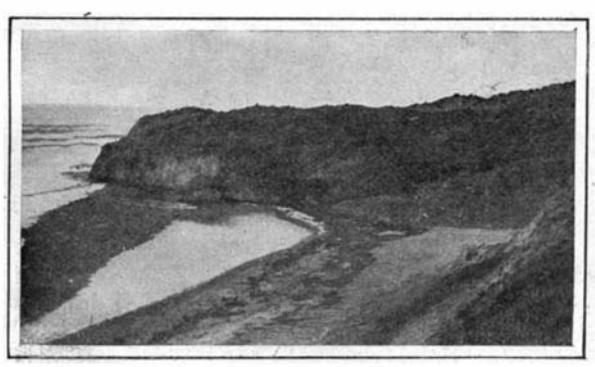
The Post Office and the Neighboring Sidewalk Were Torn Apart Leaving a Crack That Varied from Six to Ten Inches.



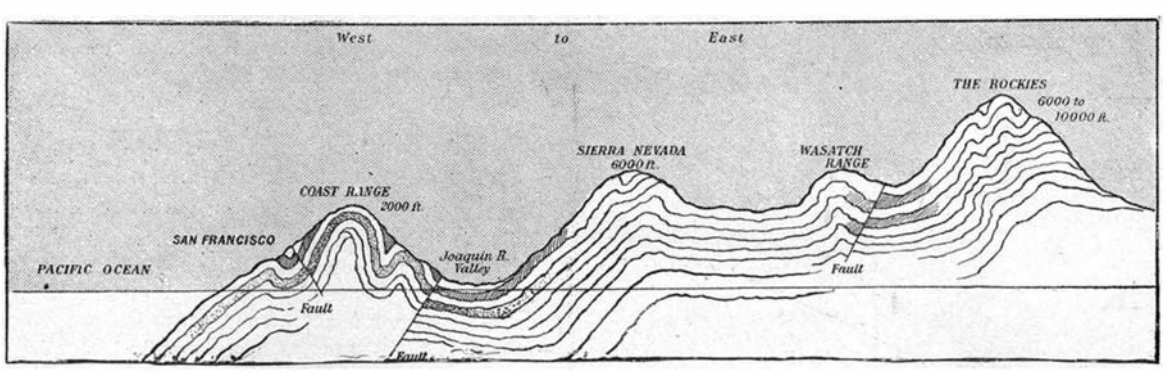
Record of Earthquake Made at Napa, Cal.

Fissure Produced by the Earthquake in a San Francisco Street.

Street and Railroad Track Elevated by the Earthquake at the Post Office.



Point of New Land Formed Four Miles from Colma, Cal.

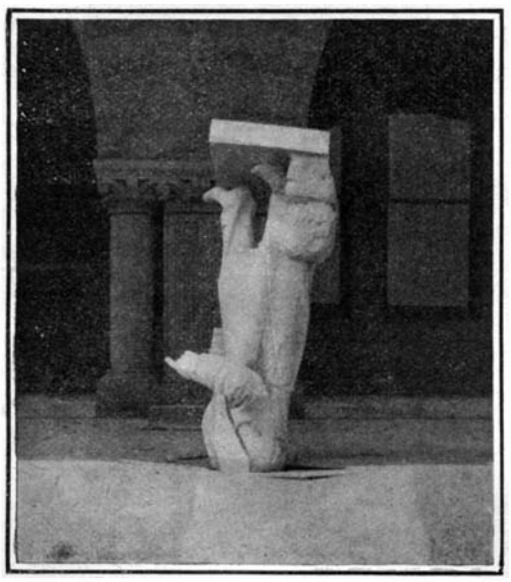


The Crumpling of the Pacific Coast Strata; the Earthquake Was Due to the Slipping at a Fault.

EFFECTS OF THE EARTHQUAKE AND FIRE UPON THE CITY OF SAN FRANCISCO AND ITS BUILDINGS.

when the first impulse is single, or, if compound, the varying impulses seem to be merged into one severe shock, then this initial shock may be followed by one, two, or three others; they rapidly grow weaker and wane into imperceptible tremors. That is what the San Francisco earthquake did. There were from twenty-five to thirty impulses. At the students' observatory at Berkeley, from April 18 to 26, inclusive, thirty-two tremors were recorded, the highest intensity registered according to the Rossi-Forel scale being 5, and the longest duration being eight seconds.

After a careful examination of the business district of San Francisco, some of the best architects and structural engineers have come to the conclusion that Class



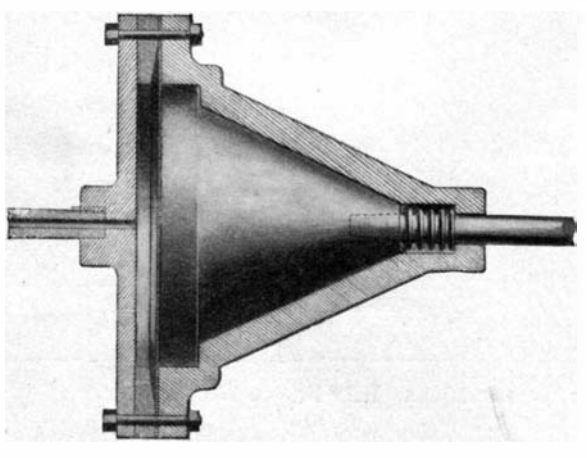
THE STATUE OF AGASSIZ IN ITS PRESENT POSITION.

A buildings can be made fire-proof and earthquake-proof. The Merchants' Exchange Building, the Claus Spreckels Building, the Kohl (formerly Hayward) Building, the Grant Building, the Chronicle Building, the St. Francis and Fairmount Hotels, show that a city can be built of structures that will come almost unscathed out of such an ordeal as the earthquake and fire that recently laid San Francisco waste. A strictly Class A building is one into the construction of which wood does not enter.

The finest buildings of the city, though gutted of everything that was not steel, concrete, granite, or marble, are still structurally sound. The principal ones standing are the Merchants' Exchange Building, the Mills Building, the Kohl Building, the Crocker Building, the Union Trust Building, the United States mint, the new United States post office, the James Flood Building, the Hotel Hamilton, the St. Francis Hotel and the Hotel Alexander next to it; the Shreve Building, the Claus Spreckels Building (the tallest building in the city), the Mutual Savings Bank Building, opposite to it; the new fifteen-story Chronicle Building, the Sloane Building and the Telephone Company's building on Bush Street. The Pacific Mutual Life Building and the great Fairmount Hotel are structurally sound. The Appraisers' Building on Washington and Battery Streets, though surrounded by ruins, was undisturbed by earthquake or fire.

AN IMPROVED ADJUSTABLE CLUTCH.

Pictured in the accompanying engraving is a clutch of such construction that it can be very accurately adjusted for transmitting various powers. The clutch is a friction clutch of the cone type, and its chief novelty lies in the fact that it is operated by hydraulic pressure, the water being admitted to the clutch through a hollow shaft. Carried by the other shaft is a cone formed with a step or annular shoulder at its base. Fitted over the cone is a casing formed with a recess to admit this shoulder. At the apex of the cone another recess is formed in the casing to receive a coil spring which presses against the cone and holds it clear of the casing. The cone shaft passes freely through an opening in the casing. Attached to the opposite end of the casing is a steel diaphragm. Over this diaphragm a ring is placed, and it serves to space the diaphragm from the rear cover plate of the clutch, which is bolted to a flange of the casing. A chamber is thus formed between the diaphragm and the plate, and this chamber communicates through a port in the plate with the hollow shaft of the clutch. The plate is keyed to this shaft, so that when the latter turns it carries with it the diaphragm and the cone casing, but normally it moves independently of the other shaft and its cone. However, when water is admitted into the chamber, it flexes the diaphragm against the cone, firmly seating the latter in the casing, and thus coupling the shafts together. The frictional engagement of the cone and casing may be easily regulated by controlling the pressure of the water. The inventor of this improved clutch is Mr. Rutgers S. Kasson, of 1306 Delaware Avenue, Wilmington, Del.



HYDRAULICALLY OPERATED FRICTION CLUTCH.

The International Aeronautic Cup.

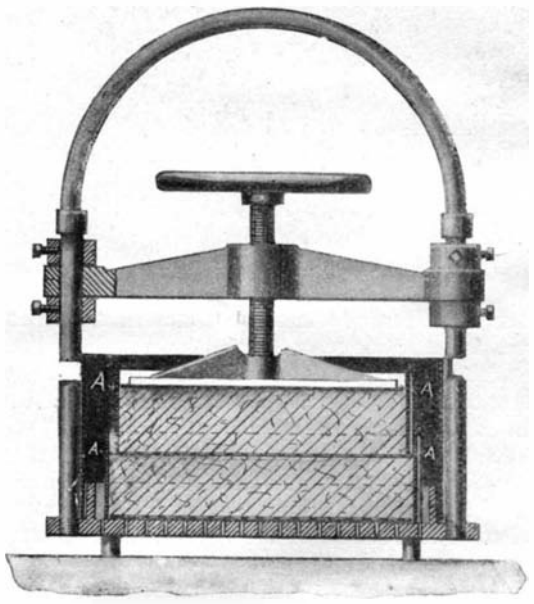
We have been able to obtain some particulars as to the engagements which have been entered at the Aero Club of France for the International Aeronautic Cup. This event has been founded by Mr. James Gordon Bennett and bids fair to be of exceptional interest, seeing that a number of balloons of different types and coming from several countries of Europe as well as from America are to be represented. The list of engagements has already closed at the Aero Club. Among the balloons which are to take part in the event we note the following: From Germany we have two entries from the aeronautic club known as Deutscher Luftschiffer Verein. The first is Baron von Hewald, of Berlin, who has a record of seventeen balloon ascensions, and will pilot a large balloon. Second comes M. Hugo (an assumed name) who has already made fifty-nine ascensions. Belgium enters the ranks under the auspices of the Aero Club de Belgique. M. Van den Driesche, who distinguished himself in different events held in Belgium last year, will mount the "Ojouki," a balloon of 2,500 cubic yards, made of China silk. The Spanish champions are J. F. Duro, the winner of the Pyrenees Cup; Capt. Kindelau, winner of the Madrid concourse; and Don Esteban Guteriez, of Salamanca. The Spanish aeronauts will have three balloons of 2,300 cubic yards. Italy is represented by Alfred Vonwiller, a member of the Societa Aeronautica Italiana, and a well-known champion, having made one of the most recent passages across the Channel and several other fine performances. He will mount a balloon of French silk, of 1,800 cubic yards, the "Elfe." As regards the English, American, and French entries we will give the details very shortly. The event is to take place on the 30th of September, 1906, and will no doubt be one of great interest as well as an aid in the development of aeronautics.

A Prize for an Automobile Road Indicator.

Baron Henri de Rothschild has offered the sum of $200 to the Paris Academy of Sports to establish a prize for the best form of "odotachymeter" or instrument for use on an automobile or any other kind of car for indicating at the same time the distance which has been traveled over and the instantaneous speed at any given moment. A concourse of such devices is to be held by the academy and the above amount will be awarded in one or several prizes. The Technical Committee of the French Automobile Club has been charged with drawing up the regulations for the concourse and naming the jury. According to these rules the international concourse will be held on the first of May and the following days. The prizes will be awarded for one or several apparatus which best answer the conditions of the tests. The competitors are to furnish a drawing or detailed description of the apparatus and also an actual instrument mounted upon an automobile of a type which is accepted by the Commission.

AN IMPROVED HAND-OPERATED MEAT PRESS.

The accompanying engraving illustrates a new hand press which is adapted particularly for pressing meat, although it can also be used for pressing fruit and vegetables. Meat pressers as heretofore constructed have usually been made with but a single meat box. The construction here illustrated comprises a series of meat boxes, each fitting into the one below, so that the device can be used for compressing any desired amount of meat within the limits of the press by simply using the required number of meat boxes. Furthermore, by the use of different boxes, a number of different kinds of meat can be pressed at the same time. The boxes with the meat pressed therein can be placed in an ice box, or the press itself can be provided with an ice-holder, so that the meat can be left to cool under pressure. The press is of simple construction, comprising a perforated base supported on four short legs, and carrying two upright standards which are braced together at their upper end by an arched coupling member. A crosshead is mounted on these standards and can be secured at any desired height by means of collars adjustable on the standards. Threaded through the crosshead is a hand-screw, which is adapted to press the press-plate down onto the meat. The boxes for the meat are so made that they can be readily taken apart when desired, to remove the meat. Each box consists of two angle pieces, which are fastened together at opposite corners by hinge pins. The boxes have no bottoms, but perforated plates are placed between the layers of meat. Each box is formed with grooves at opposite corners, which serve as guides for the box above; also with a series of perforations, *A*, through which the water and grease expressed from the meat in the box above may pour out. Vertical walls on the base serve to confine these liquids so that

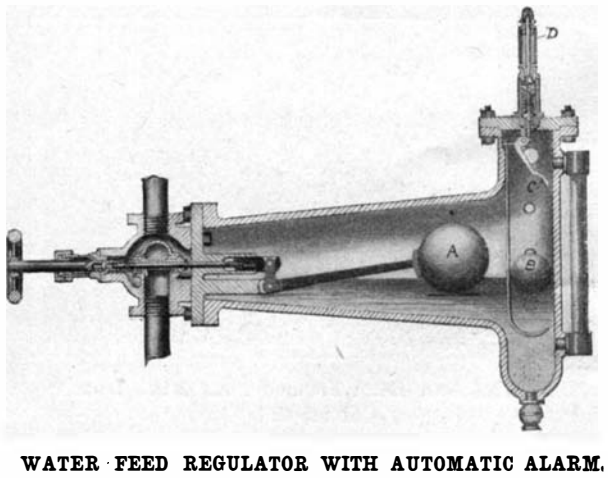


A MULTIPLE MEAT PRESS.

they will pour through the perforations in the base-plate. When it is desired to cool the meat in the press, a large box is placed about the meat boxes, as shown in the illustration, and this is filled with ice. Mr. Jacob Spengler, of 515 Tenth Street, North Great Falls, Mont., is the inventor of this improved meat press.

WATER-FEED REGULATOR WITH AUTOMATIC ALARM.

A patent has recently been granted to Mr. H. W. Adams, of Fargo, North Dakota, on an apparatus for regulating the supply of water to boilers, which is provided with both high and low water signal devices. Our illustration shows a section of the improved apparatus. The main casing of the regulator is formed with a horizontal body portion ending in a vertical head. The latter is provided with the usual steam and water connections, and carries the gage-glass and gage-cocks. Within the main body of the casing is a spherical float, *A*, attached to the longer arm of a bell-crank lever. This lever is fulcrumed to a bracket, and its shorter arm engages a slide. Connected by a threaded stem with this slide is a valve, which operates to close or open the feed-pipe of the boiler. The position of the valve can be regulated by screwing the stem into the slide. This is done by means of a short rod which has pin-and-slot connection with the stem, as clearly shown in the engraving. Under the float, *A*, is a plate, secured thereto, which serves to prevent the float from jumping or churning under the action of the feed pump. The signal float, *B*, is placed in the vertical head of the regulator, and at the upper end of the chamber is a bell-crank lever, *C*. Attached to the shorter arm of the lever is a rod, which serves to retain the float, *B*, in its proper position. At its lower end this rod is curved under the float. When the water falls dangerously low in the chamber, the float, *B*, will rest on the curved end of the rod, and swing the lever, *C*, on its fulcrum. A boss on the latter will then lift the valve, admitting steam to the whistle, *D*. The engineer will thus be signaled that there is something the matter with his feed pump or that the regulator valve has jammed. Similarly, when the water rises too high in the regulator chamber, the float, *B*, will strike the longer arm of the lever, *C*, lifting the whistle valve and sounding the danger signal.



WATER FEED REGULATOR WITH AUTOMATIC ALARM.

RECENTLY PATENTED INVENTIONS.

Of Interest to Farmers.

WHEAT-SHOCKER.—G. R. KELTNER, Covington, Oklahoma Ter. This shocker is adapted for attachment to a harvesting-machine, taking the place of the bundle-carrier, and so located with reference to the harvester as to receive bundles from the binding table. As it receives the bundles they are fed in standing position, butt downward, upon a platform and are packed in curved guard-arms and wherein the platform is slid from beneath the packed bundles, which are received on horizontal fingers; which being automatically dropped the bundles slide to the ground and platform returns to normal position to receive other bundles.

GRAIN-CONVEYER.—J. W. SCHAUER, Kalispell, Mont. Mr. Schauer's invention has for its aim the provision of a simple and efficient grain-conveyer for use in connection with threshing-machines, and especially in connection with those employing a band-cutter and feeder. A great saving of manual labor is effected in supplying bundles to the threshing-machine.

DRAFT-EQUALIZER.—H. C. SCOTT, Ritzville, Wash. The object of the invention is to provide an equalizer arranged to distribute the load to be hauled equally to the animals in the team, to reduce the friction of the working parts to a minimum and to provide a comparatively short but very strong and durable equalizer not liable to get out of order nor cause entanglement to the animals when not in use.

CORN-SNAPPER AND FEED-CUTTER.—F. T. MARTIN, Winchester, Ky. In this instance the invention has for its object the provision of a machine adapted to take the stalks of corn as cut from the field with the fodder and ears still connected to the stalks and to snap or tear off the ears from the stalks and in the same operation cut the stalks and blades into short lengths for rough feed.

Of General Interest.

DUST-CAP AND SOLAR EYEPIECE FOR TELESCOPES.—F. B. WARNER, New York, N. Y.—The invention has reference to improvements in combined dust-caps and solar eyepieces for telescopes, the object being to provide a device of this character that may be manufactured at small cost. The cap is employed for protecting the eye-lens from dust when the telescope is not in use in the usual manner, and the cap is to be used on the telescope when making observations of the sun.

GOODS-HANDLER.—W. R. CALVERT, Louisville, Ky. This invention is an improvement in goods-handlers. By means of a lug attached to an enlargement at the lower end of a rod, the jaws may be opened and the article grasped therebetween, after which the lug is released, a spring maintaining a firm grip of the jaws upon the article. In practice this lug may be manipulated by the thumb, while the forefinger would engage another lug to prevent rotation of the tube with respect to the hand.

PROPELLER ATTACHMENT FOR BOATS.—A. E. HAUCK, New York, N. Y. Mr. Hauck's invention is an improvement in that class of propellers which are adapted to be detachably connected with boats and suspended in the water at the stern. A rectangular metal platform or frame is adapted to be placed and supported upon the rear or stern portion of a boat. A frame carries the propelling mechanism proper and has hinged connection with the platform, but provided with means for securing it in vertical position as required for propulsion.

FILE AND FASTENER.—C. R. SMEAD, St. Paul, Minn. The object of the inventor is to securely fasten the file-wrapper, avoiding the necessity of tapes or elastic bands, permitting full expansion of the file, and at the same time permitting the wrapper to be readily opened and closed. Also, to construct a fastening device particularly useful in connection with a file of this sort and capable of securely holding the flaps of the file engaged, at same time permitting the fastening to be readily manipulated.

DOOR-FASTENING.—J. ROONEY, New York, N. Y. This invention relates particularly to improvements in doors for water-tight compartments of marine vessels, although it may be used for other purposes, such as in caissons or the like, the object being to provide a novel form of locking device to secure the door closed in a water and air-tight condition.

BOTTLE-CLOSURE.—J. PORTER and F. C. MAYER, Frostburg, Md. By this invention it is sought to provide means for holding the bottle-closure in the neck of the bottle, at the ends of which are provided means for detachable engagement with the bottle-neck, so the fastening devices may be applied to and removed from the neck of the bottle.

PROPELLER.—F. C. GORDON, Asotin, Wash. In the present patent the invention has reference to a propeller in which the blades are reversible, so that the shaft turning continuously in one direction may be made to turn the vessel ahead or astern to exercise no propelling action thereon.

DRAFTING INSTRUMENT.—A. A. ALLEN, Ortonville, Minn. The object of the invention is to provide a new and improved drafting instrument, more especially designed for the use of tinners, plumbers, and other mechanics in laying out the blanks for forming elbows, T's, and other articles of sheet metal and like material. It is a division of the application for Letters Patent of the United States formerly filed by Mr. Allen.

CONDENSER FOR TOBACCO-PIPES.—C. G. BUSCHOW, Westfield, N. Y. The object in this improvement is to produce a device whereby the injurious effects of nicotin will be materially lessened, if not entirely eliminated, and also to produce a pipe provided with improvements which can be kept in a sanitary condition, and one whereby a cool and delightful smoke can be had without the disagreeable burning and swelling sensation so common with the use of ordinary pipes, and one in which flavor of tobacco is not destroyed.

TWINE-HOLDER AND TAKE-UP.—F. W. COPCUTT, New York, N. Y. The aim of the invention is to provide a twine holder and take-up which can be readily hung up in any desired place, and is arranged to retract a certain amount of the twine after being released by the operator to remove the end of the twine from the counter. It relates to holders and take-ups such as shown and described in Letters Patent of the United States formerly granted to Mr. Copcutt.

RAIN-ALARM.—V. A. DEVER, Philadelphia, Pa. The invention relates to automatic alarm devices; and the object of the invention is to produce a device of this kind which is especially adapted to give an alarm if it should begin to rain. It is intended to be most useful for the purpose of preventing damage to curtains or furniture in the neighborhood of open windows in residences or apartments.

Hardware.

GAGE.—E. H. BATEMAN, Baldur, Canada. Special means are employed by this inventor both for supporting a knife for cutting laces or strips from a body of leather or other material and for maintaining the knife or blade in truly operative position during the cutting operations, special means being also used for adjusting the blade or knife within the first-named special means as the cutting edge thereof becomes worn down from use, said second-named special means also serving to hold the blade or knife to its work.

TRIPLE-GAGE, BUTT-GAGE, AND TOOL HOLDER.—P. GYSSLER, Cleveland, Ohio. The principal object of the invention is to provide a convenient holder with means for holding gages, squares, paring-chisels, scribers, compasses, keyhole-saws, and the like in a convenient and simple manner and to provide means for affording adjustments for certain of these parts. It relates to a triple-gage, butt-gage, and tool holder for implements used in woodworking and carpentry.

TOOL FOR CUTTING AND FITTING BOILER-TUBES.—P. W. CHAMBERLAIN and E. G. CHAMBERLAIN, Greytown, Nicaragua. The invention relates to that class of tools which are used for expanding the ends of boiler-tubes into the heads of boilers so as to tightly and firmly seat them therein. It consists in means whereby the tool may be so gaged or adjusted and be taken out from time to time and reinserted, so as to accurately come again into the same plane of action or any modification of the position necessary to correct errors or enable it to work in any desired plane.

Household Utilities.

CURTAIN-FIXTURE. — P. F. MCCARTY, Washington, D. C. In the operation of the invention a bracket may be engaged by its hook with an outwardly-projecting bead of a supporting-frame and its tongue be forced into engagement with any of the notches, the spring afforded by lateral deflection tending to bind the tongue securely in manner as to prevent displacement of the bracket without interfering with its application to and removal from the supporting sections, as may be desired.

Machines and Mechanical Devices.

DRAWING-MACHINE FOR COKE-OVENS.—R. D. MARTIN, Las Esperanzas, Coahuila, Mexico. The object of the present invention is to provide a machine arranged to allow convenient manipulation of the machine through the small door of the coke-oven, and to permit discharging the coke from the oven underneath the machine without interference with the working parts of the machine. The invention relates to drawing-machines, such as shown and described in the Letters Patent of the United States, formerly granted to Mr. Martin.

GOVERNOR FOR SPRING-MOTORS.—W. B. KIRBY, Wellington, Texas. When the motor is running, motion is transmitted to a shaft and through a pinion and gear-wheel to a spindle, and motion of said spindle to toggle-levers through bevel-pinions, so as to resolve the said levers in a direction opposite to that of the spindle. Motion becoming excessive and levers are thrown out by centrifugal force, the brake-shoes will be thrown into engagement with the collar on the spindle, and the shoes revolving in a direction opposite to that of the spindle the speed of the motor will be quickly checked.

TENSION DEVICE FOR WARP-BEAMS.—G. KELLER, New York, N. Y. The object of the present invention is to provide a device for warp-beams or warp-carrying spools arranged to permit minute and convenient regulation for producing the desired tension on the warp, according to the nature thereof, and to provide a long range of movement of the beam. It relates to devices—such, for instance, as shown and described in former Letters Patent of the United States.

REGULATOR OR GOVERNOR.—J. W. BOYLE, Unity Station, Pa. The invention relates especially to means for regulating or governing the speed of movement of machinery. It is useful in connection with all classes of machinery, particularly for elevators, inclined railways, oil or gas well machinery, vehicles, and the like. Fluid of any sort may be employed in connection with the apparatus. Oil is preferable; but an elastic fluid, such as air, may be used, if desired.

CLUTCH.—N. E. SWANSON, York, Neb. This invention has reference to a friction-clutch of that class in which a ring is expanded or contracted against a shell or drum to fasten the two members together; and it consists in various improvements in the construction and assemblage of the device, among which may be enumerated the arrangement of the shell with the band and its carrier and the device for acting on the band to expand it.

STAVE-PRESS.—J. B. SCHOFIELD, Tomahawk, Wis. In this case the improvement refers to a press for use in bundling staves and for similar purposes. The principal objects are to provide means whereby top and bottom clamps can be forced toward each other simultaneously and at the same time preserve the curves of the staves and prevent flattening them out.

MACHINE FOR COMPUTING INTEREST.—C. A. MARBLE, Ottumwa, Iowa. The principal feature is a series of rotatable members, each comprising nine rollers, arranged parallel around a common axis and each inscribed on its periphery with numbers indicating different amounts of interest on given sum for a given time. They have a planetary motion—that is, each is rotatable on its own axis and bodily around the common central axis. They are designated "multiple cylinders." Means for rotating or adjusting, locking, and releasing these members or cylinders as a whole and their individual component rollers further embody special features.

FABRIC-FOLDING MACHINE.—M. ISAACS and M. PELLAR, New York, N. Y. It is the usual practice preparatory to cutting handkerchiefs or garments to place the goods in several layers on a cutting-table, and as the table is considerably long much time is consumed by a person walking back and forth to manually form the layers and to keep the layers straight or even one upon the other. The object is to provide a machine of simple construction by means of which the several layers of fabric may be quickly and evenly placed.

PLANING-MACHINE.—G. A. ENSIGN, Defiance, Ohio. Mr. Ensign's invention relates to woodworking machinery, and more particularly to planing apparatus such as shown and described in the Letters Patent of the United States formerly granted to him. The object of the invention is to provide a new and improved planing-machine for planing fellies cut from the solid wood and without danger of splitting or roughing the inner and outer peripheral surfaces.

Prime Movers and Their Accessories.

MOTOR.—I. J. PADDOCK, Percival, Iowa. The invention comprises an endless chain belt, which belt has articulated and folding wings arranged within a tapering inclosing casing, which casing incloses one portion of the belt and its hinged wings and has an inlet at its small end for the steam or other fluid under pressure, so that as the pressure of this fluid comes upon the wings they open and bear in the travel of the belt against the casing and by gradually unfolding expose their surfaces to the pressure of the fluid.

Railways and Their Accessories.

CROSS-TIE CUTTER.—R. S. WRIGHT, Nelson, Ark. This invention has reference to improvements in machines for cutting out or shaping railway cross-ties from the rough timber, the object being the provision of a machine of this character by means of which the work may be rapidly done and making up the ties of uniform size.

JOURNAL-LUBRICATOR.—C. H. TURNER, New York, N. Y. This invention relates to improvements in devices for applying lubricant to car-wheel journals, the object being to provide a device of this character that may be readily placed in a journal-box of the usual construction. In operation the lubricant will be taken up from the lower portion of the journal-box and applied by the rollers to the journal.

Pertaining to Recreation.

TOY FISH-TANK.—E. T. SULZER, New York, N. Y. This amusement apparatus comprises a tank for receiving water and artificial fish to move about in the tank. The fish are provided with pieces of iron, so that they may be magnetized for catching them on hooks formed of magnets and for providing for their motion. The inventor prefers to secure this motion by means of magnets located adjacent to the tank and moved in the vicinity thereof out of sight.

MERRY-GO-ROUND. — G. B. MCKINNEY, Barry, Ill. The aim of this invention is to provide novel details of construction for a machine which are extremely simple and durable, adapt the same for the simultaneous rotation of one or more individuals, and enable those mounted upon the machine to communicate rotary motion thereto by hand and foot power in a convenient manner, thus affording amusement and healthful exercise to the riders.

Pertaining to Vehicles.

BRAKE MECHANISM FOR VEHICLES.—G. D. BUCHANAN, Saratoga, Wyo. The mechanism includes means for applying brakes to front wheels of a vehicle in addition to brake mechanism employed with the hind wheels thereof, detachable supplementary operating mechanism being provided, adapting the invention to be used with or without the wagon-body. It may be applied to ordinary vehicles of the class for which it is intended and adapted when thus attached to be connected with rear brake mechanism of the vehicle to be operated simultaneously therewith.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 8089.—Wanted, manufacturers of rotary, gas, gasoline and oil engines and turbines.

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Inquiry No. 8090.—For manufacturers of machinery that grinds leather scraps into a pulp; also manufacturers of leather door knobs.

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Inquiry No. 8094.—For manufacturers of positive rotary air compressors, delivering from one to five pounds pressure.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company. Foot of East 138th Street, New York.

Inquiry No. 8095.—For manufacturers of clock systems, consisting of one master clock controlling any number of secondary clocks.

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Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery tools, and wood fiber products. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

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Automobile experts are in constant demand at high salaries. Our seven weeks' course is the most thorough and practical, fitting men to drive, handle and repair. Day and evening classes. Special course for owners. New York School of Automobile Engineers, 146 West 56th Street, New York.

Inquiry No. 8098.—For manufacturers of repairs for the Curtis & Mitchell foot power printing presses.

WANTED.—The partial services of several men who have facilities for observing, and ability to comprehend the performance and good features of different automobiles. The work will occupy little time, and be chiefly in the nature of correspondence. Address Thomas B. Jeffery & Company, Kenosha, Wis. Department of Construction.

Inquiry No. 8099.—For manufacturers of a cheap substitute for celluloid.

A—HAS YOUR BUSINESS USE FOR A MAN who can devise and execute plans for advertising developing sales, minimizing expense through labor-saving methods, accounting, finances, credits and collections? Advertiser has original ideas, thoroughly practical experience, seventeen years corporation secretary, the last fourteen in prominent company, in which he successfully handled a million dollar advertising appropriation and to which he refers. Other high-class references. G. S. Curtis, 299 Mercer St., N. Y.

Inquiry No. 8100.—For manufacturers of dairy machinery for making butter and cheese, capacity 10,000 liters of milk.

Inquiry No. 8101.—For parties installing incubators of different sizes, capacity 2, 5 and 10,000 chickens.

Inquiry No. 8102.—For parties installing large drying chambers of the most perfect kind for drying fruits, with a capacity for a very large number of fruits.

Inquiry No. 8103.—For manufacturers of grinding mills for preparing flour, barley, oats, malt, peas, lentils, beans, maize, etc.

Inquiry No. 8104.—For manufacturers of small looms and mechanical spinning machinery for preparing silk fabrics, etc.

Inquiry No. 8105.—For manufacturers of small looms and mechanical spinning machinery for preparing hemp, jute, linen, ramie, etc.

Inquiry No. 8106.—For parties installing machinery on a large scale for preserving fruits and vegetables, such as asparagus, tomatoes, green peas, peaches, pears, apples, grapes, etc.

Inquiry No. 8107.—For parties installing machinery for drawing oil from peanuts, almonds, olives, etc.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

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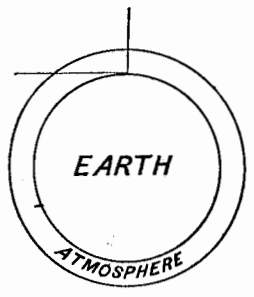
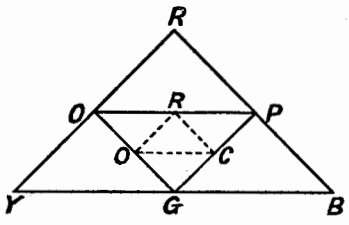
Minerals sent for examination should be distinctly marked or labeled.

(9976) A. X. says: 1. Our text in physcs says that a body in a vacuum on top of a mountain is lighter than it is in the morning. What is your opinion? A. This letter claims to come from a high school—from a scholar, we assume. It is written with a lead pencil, which no person should use in writing a letter, unless to a very intimate friend. There are errors in grammar. Even the word *physics* is misspelled. We have printed it as it is, with the hope that boys who read it may be stirred up to do better by seeing the mistakes of others. 1. There seems to be no sense in this question. What connection the "morning" has with the top of a "mountain" we are not able to see. A body weighs more on the top of a mountain than it does at the sea level at any time, since it is farther from the center of the earth on the mountain top. 2. Also in regard to this problem: They say that we receive more heat when the sun's rays

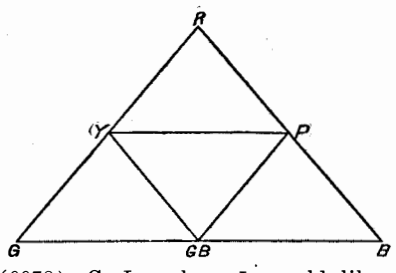


are vertical than when horizontal. In the diagram above I represent the earth and the atmosphere. They say that we receive only one-third of the heat. Now there is nearly the same relation in the two distances. What is the cause? A. We receive much more heat at noon, when the sun is highest and the rays more nearly vertical, than at sunset, when the rays are horizontal. Every one who observes knows this fact without studying a book. Your diagram does not show the true proportion of the earth and the atmosphere. The earth is nearly 8,000 miles in diameter, and the air is perhaps 300—from 150 to 300—miles high. The fact is that the sun's rays at setting pass through 35.5 times as much air as when the sun is in the zenith. This is not, as you say, nearly the same relation in the two distances. You may find interest in reading about this matter on pages 21 to 30 of Waldo's "Elementary Meteorology," which we can send for $1.75. It should be in your high school library. 3. In this part of the State this year many threshing machines have blown up and been destroyed by fire. Some attribute this to what is called smut in the wheat. Some say that the felts generate electricity and make a spark, which causes it to ignite. It makes a very violent explosion, and the fire seems to spread as though there was a gas present. If you so desire, I can send you some of the smut. A. We have no theory to offer for more frequent fires this year than in any other year in threshing machines. Dust is always easily set on fire and burns very rapidly, as rapidly as a gas. Perhaps the dust of the smut is the cause. The writer was well acquainted with wheat smut, having known it when a boy in threshing by hand.

(9977) S. G. M. writes: In Notes and Queries of Sept. 2, 1905, (9748), it is stated that green is the complementary color of purple or violet. I doubt it for this reason: The prism is composed of primary, secondary, and tertiary colors (subdivisions of the latter are mere tones). If you establish a triangle you have red, blue, and yellow as "primary" colors. Now to obtain the secondary or "complementary" colors, you draw an inner triangle to the first, thus:



and by mixing the two primaries opposite red you obtain green, opposite blue you have orange, and opposite yellow you get purple. A third triangle inside the secondaries produces the tertiaries, or to give them a name olive, russet, and citrine. Therefore purple is complementary to yellow in their relations as primary and secondary, but purple's harmony also is found in the tertiary, and that would be olive. I am open to contradiction with proof. A. When we gave the complementary color of purple as green we followed the best authorities as well as our own knowledge of the subject, based upon much experimental work. See Query 9275, Vol. 90, No. 3. It is not a question of a triangle or color scheme, but one of fact. The color triangle must express the fact, or else it is so much the worse for the color triangle. Perhaps if you should begin with red, green, and blue as primary colors, as all scientific authorities agree to do, you might come out more correctly. If Rood's "Modern Chromatics" is accessible to you, you will find in Chapter VI., page 164, the statement that green and purple are complementaries. Blue is the complementary of yellow, and not purple, as you give it. The triangle is then as follows:



(9978) G. L. asks: I would like to know if earthworms are a benefit or an injury to plants. A. Earthworms are mainly beneficial to plants by plowing up the soil, letting air into the roots of plants, and bringing the lower soil up to the surface. They also injure young plants by uprooting them, or drawing them into their holes. Darwin's book upon earthworms, which we furnish for $1.50, covers a fine investigation into the useful work of this creature upon the soil.

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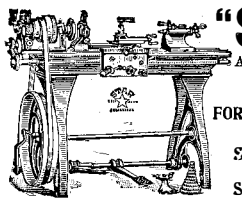

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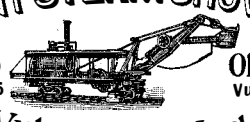

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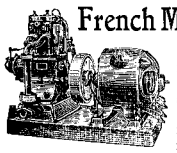

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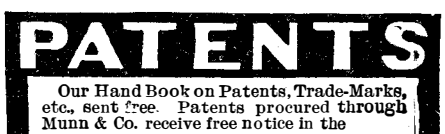

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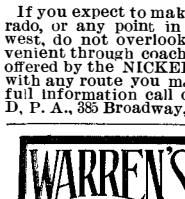

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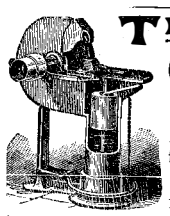

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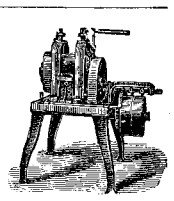

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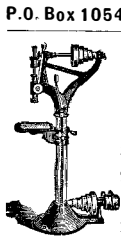

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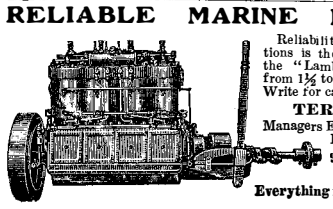

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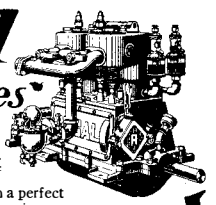

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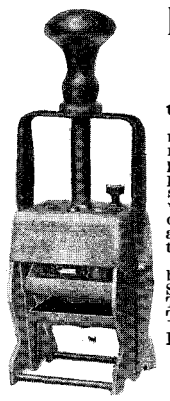

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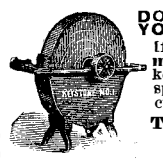

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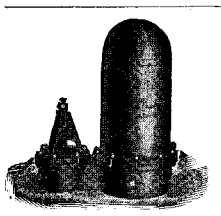

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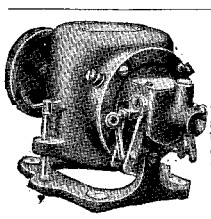

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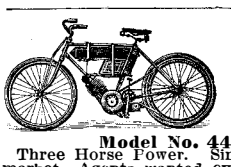

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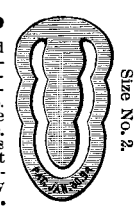

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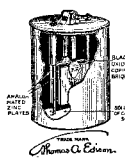

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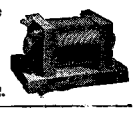

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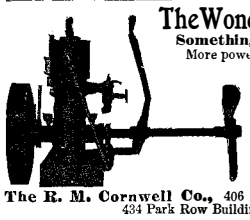

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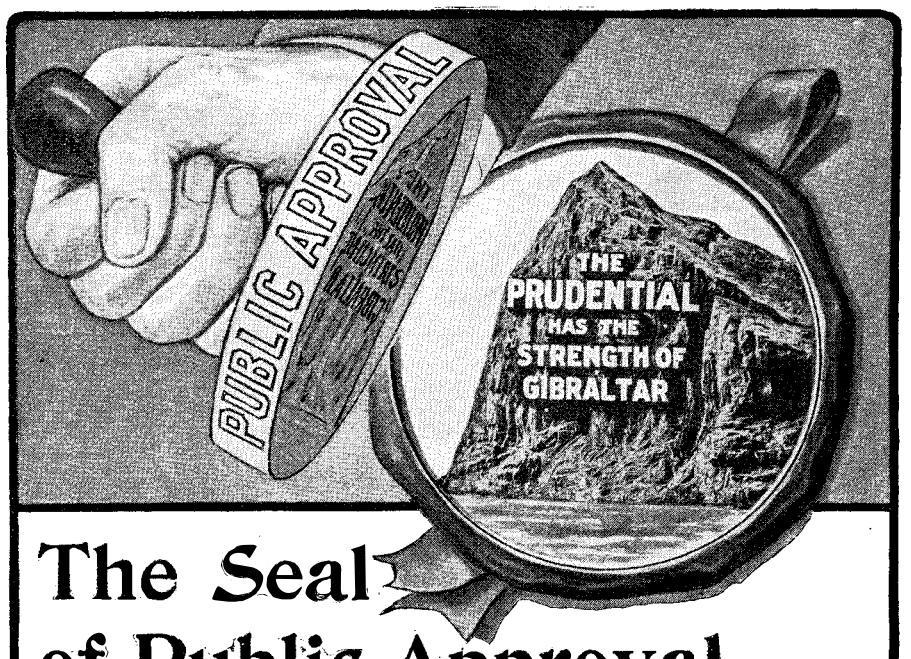

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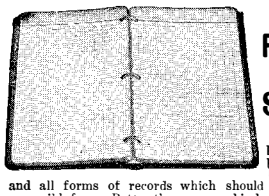

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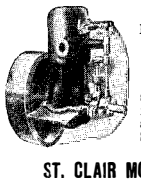

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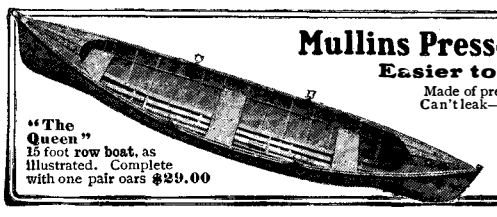

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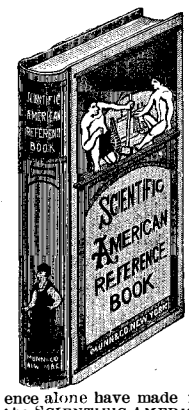

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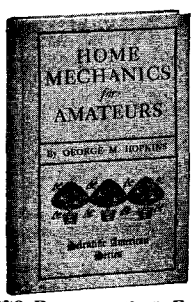

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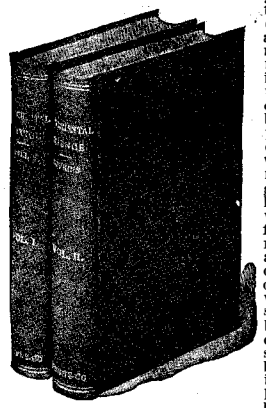

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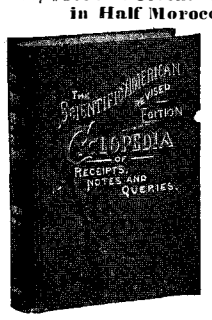

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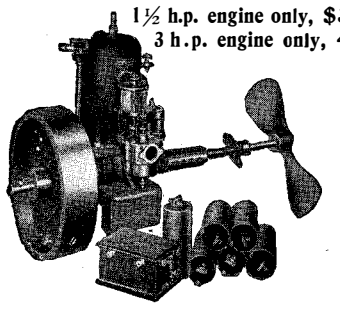

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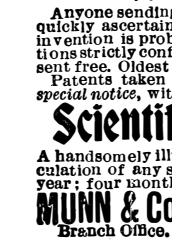

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Sumac, gambier, oak, and hemlock extracts, G. H. Leonard & Co.	52,464
Suspenders, Pioneer Suspender Co.	52,371
Suspensory bandages and trusses, J. Ellwood Lee Co.	52,422
Syrup, Griggs, Cooper & Co.	52,326
Tea, Dolan Mercantile Co.	52,514
Thread, cotton, Clark Mile-End Spool Cotton Co.	52,355
Tobacco, chewing and smoking, Hoffman & Co.	52,486
Tobacco, smoking and chewing, Gilbert, Son & Co.	52,419
Tonic for the regulation of the alimentary organs, Brand Brothers Co.	52,451
Tonic, powdered nerve and muscle, E. T. Richards	52,500
Toothache wax, O. F. Leonhardt	52,457
Trunks, valises, and satchels, P. C. Murphy Trunk Co.	52,368
Twine, Fulton Bag and Cotton Mills	52,482
Valves, blow-off, Lunkenheimer Co.	52,336
Velvets, A. L. Dreyfuss & Co.	52,357
Washing machines, rotary, Benbow-Brammer Manufacturing Co.	52,437
Water, lithia spring, Londonderry Lithia Spring Water Co.	52,334
Wheels, metallic rims for vehicle, Clincher Automobile Tire Manufacturers' Association	52,293
Whisky, L. Kahn & Co.	52,270
Whisky, Star Distillery Co.	52,280
Whisky, Lang, Schenck & Co.	52,334
Whisky, Blutenthal & Bickart	52,460
Whisky, Fairfax & Co.	52,479
Whisky, W. Schneider W. W. & L. Co.	52,494
Whisky, Star Distillery Co.	52,545
Whisky, malt, S. Binswanger & Bro.	52,504
Wine, W. H. Jones & Co.	52,522
Wine in bottles, white, Compania Vinicola del Norte de Espana	52,509
Wire cloths and screens, W. S. Tyler Co.	52,388
Wringers and the parts thereof, clothes, American Wringer Co.	52,406
Yarns, woolen, worsted, and mohair, Henry E. Frankenberg Co.	52,442, 52,443

LABELS.

"Ambrosia Pure Chocolate Wafers," for confectionery, Ambrosia Chocolate Co.	12,860
"Chockorn," for a bonbon, L. C. Paschal	12,859
"Circleanum," for a cancer remedy, A. V. H. Wakeman	12,865
"Clay-Ola," for cigars, O. L. Schwenke Lithographic Co.	12,843
"Cleverettes," for cigars, Schmidt & Co.	12,848
"El Scientifico," for cigars, O. L. Schwenke Lithographic Co.	12,842
"Elegant," for flour, Pensacola Grocery Co.	12,856
"Greater Than King," for cigars, B. Lyon	12,849
"Indian," for cocoa, Pennsylvania Chocolate Co.	12,852
"Indian," for chocolate, Pennsylvania Chocolate Co.	12,853 to 12,855
"Kermer's 'E. T.' (Every Time", for a medicine, C. F. Merker	12,866
"Knoch," for cigars, W. Knoch	12,846
"La Mertina," for cigars, A. Mertens	12,850
"Little Victor," for cigars, O. L. Schwenke Lithographic Co.	12,845
"Mashallah Coffee," for coffee, M. Horowitz	12,851
"Mentho Camph," for an ointment, M. G. Slocum	12,864
"Mercedes," for cigars, Schmidt & Co.	12,847
"Nauvoo Brand Garments," for knitted combination union suits, Ensign Knitting Co.	12,869
"Prime," for thread and cotton, I. J. Silverstein	12,871
"Red Seal Brand Medicine Dropper," for a medicine dropper, American Lithographic Co.	12,867
"Red Seal Brand Medicine Dropper," for medicine droppers, American Lithographic Co.	12,868
"Royal Cream for Shaving," for shaving cream, Royal Cream Co.	12,861
"St. Bernard Extract of Bark," for extract of bark, St. Bernard Medicine Co.	12,863
"Star Baby Egg Matzoths," for biscuits, H. S. Levy	12,858
"Star Tea Matzoths," for biscuits, H. S. Levy	12,857
"The American Girl Skirt," for ladies', misses', and children's skirts, American Skirt Manufacturing Co.	12,870
"Turtle Egg Shampoo," for a hair wash, A. K. Rex	12,862
"William Bond," for cigars, O. L. Schwenke Lithographic Co.	12,844

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"A Tricorne," for millinery and straw hats, Gage Brothers & Co.	1,642
"American Beauty," for millinery and straw hats, Gage Brothers & Co.	1,643
"Black and White," for millinery and straw hats, Gage Brothers & Co.	1,651
"Father of Waters," for flour, L. P. Hubbard	1,657
"Floral Effect," for millinery and straw hats, Gage Brothers & Co.	1,650
"Mushroom Fashion," for millinery and straw hats, Gage Brothers & Co.	1,647
"Panama Sailor," for millinery and straw hats, Gage Brothers & Co.	1,649
"Peacock Feather," for millinery and straw hats, Gage Brothers & Co.	1,644
"Picturesque Chapeau," for millinery and straw hats, Gage Brothers & Co.	1,639
"Plaid Trimmed," for millinery and straw hats, Gage Brothers & Co.	1,638
"Plateau Drape," for millinery and straw hats, Gage Brothers & Co.	1,646
"Ribbon Streamers," for millinery and straw hats, Gage Brothers & Co.	1,643
"Rose Garlanded," for millinery and straw hats, Gage Brothers & Co.	1,640
"Russell's Regulars," for playing cards, Willis W. Russell Card Co.	1,659
"Sapolin Gloss Carriage Colors," for carriage colors, Gerstendorfer Bros.	1,658
"The Singer Fashion Series," for corset covers and petticoats, Singer Sewing Machine Co.	1,652
"The Singer Fashion Series," for wedding gowns, Singer Sewing Machine Co.	1,653
"The Singer Fashion Series," for tailored traveling costumes, Singer Sewing Machine Co.	1,654
"The Singer Fashion Series," for afternoon gowns, Singer Sewing Machine Co.	1,655
"The Singer Fashion Series," for shirt-waist costumes, Singer Sewing Machine Co.	1,656
"Velvet-Box Plait," for millinery and straw hats, Gage Brothers & Co.	1,645
"Wings and Bows," for millinery and straw hats, Gage Brothers & Co.	1,641

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

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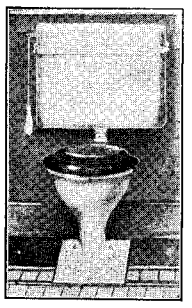

is exemplified in the SY-CLO Closet, the construction and action of which ends at once all the subtle dangers of disease raising from improper cleansing; the escape of sewer gas; the absorption of poison by the material of which common closets are made (iron for instance); and the gradual discoloration of those interior parts which furnish a prolific breeding-ground for millions of death-dealing bacilli.

The action of the SY-CLO is two-fold. Besides the copious flush of water, there is an irresistible syphonic action, which, like a powerful pump, literally pulls the contents through the outlet channel, cleansing, scouring, polishing as it goes, leaving the INSIDE of the pipe as clean and smooth as a china bowl. And this is a truism because the SY-CLO is solidly constructed of china—*pure white china*—without joint or break or rough place inside or out to furnish lodgment for dirt or disease germs.

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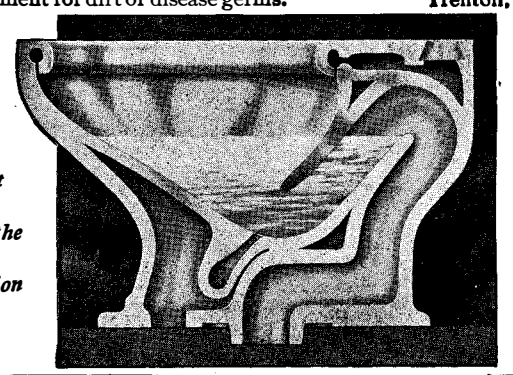
SY-CLO Closet cut in half showing the interior construction



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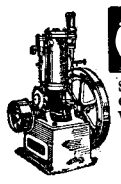

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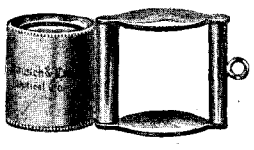

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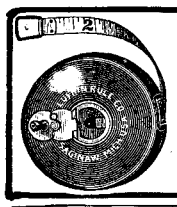

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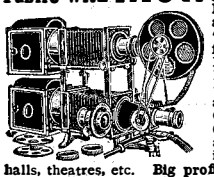

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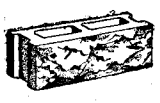

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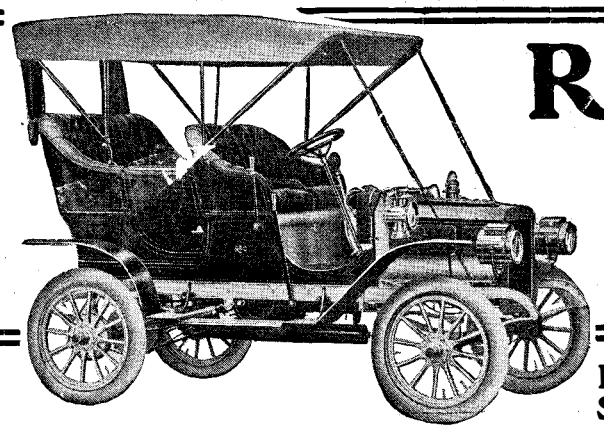

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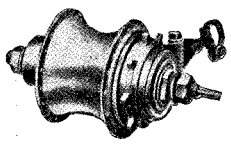

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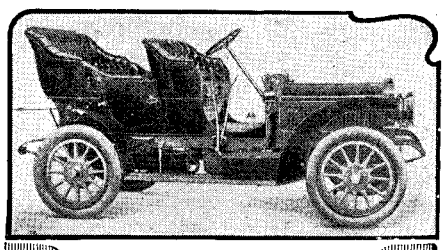

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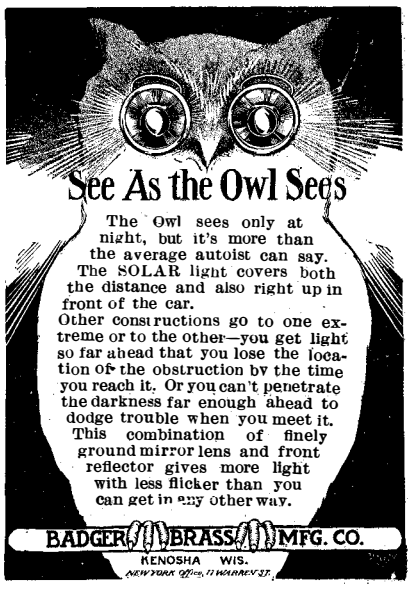

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